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INDUSTRIAL SAFETY

THE JOURNAL



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FOREWORD

THAT industrial safety is one of the chief economic problems of the United States is shown in the first article of this volume and that it is a matter of prime industrial importance is agreed to alike by employer and employee. Although many of the larger employing corporations for some years have devoted much of their resources and the effort of considerable staffs to the elimination of industrial accidents, nevertheless the public has not realized the extent of the economic and social burden which these accidents place upon the community. This volume of *The Annals* has been developed with a threefold purpose in mind.

The contributions are from those who, within the safety movement, are recognized as speaking from long and continued contact with accident prevention work. There has been a need for a compilation of articles on various phases of industrial safety which might be of value in showing the progress that has been made in reducing industrial accidents and in indicating paths to be taken which will bring further results. This volume has been so developed as to fill this need for those who have been a part of the safety movement.

The activity toward prevention of industrial accidents among various concerns and various industries has been exceedingly uneven. Many employers within industries where great progress has been made have held back from active safety work partially because of a lack of knowledge of just what accident prevention has meant and partially because of fear of expenditures which they have felt the business might not be able to afford. It is expected that this volume will be of great service to these employers

because it will show to them practical methods which have brought proved results and because, as is later pointed out, accident prevention pays. Those industries which as a whole have been backward in accident prevention methods must necessarily be interested in the articles which deal with the results that have been achieved in those industries in which most employers have organized for safety.

For the general reader who heretofore has had but little knowledge of industrial safety, this issue of *The Annals* provides both the groundwork and the superstructure necessary to an aroused interest. The contributors are widely scattered geographically and they present the important points of view and experience necessary to an understanding of accident prevention work in industry. The economic and social condition of communities will be bettered as more citizens become interested, not only in the effect of industrial accidents, but in methods by which, as citizens, they may assist in driving down the accident rate.

The development of this volume follows logical lines under the following headings:

I. THE NEED FOR SAFETY IN INDUSTRY

Twenty to twenty-five thousand are killed annually while in the course of their employment. Two million of us are suffering non-fatal accidents of varying degree. What does this mean in terms of suffering, of charity, of hospitals, of homes for the aged and for orphaned children? And what does it mean in terms of production delays, of injured organization morale, of increased costs and narrowed markets?

The mere workman's compensation bill which is added to selling price must approach \$250,000,000 annually. Is it to be wondered that employer and employe unite in the demand that all in industry become active allies in the accident reduction army?

II. THE ORGANIZED ACCIDENT PREVENTION MOVEMENT

The organized safety movement, while comparatively new in industry, has made great strides and can point to demonstrated achievements of great magnitude. Its rapid growth has been partially due to the demonstrable fact that accident prevention pays, and partly to that effective national organization, the National Safety Council. The effective direction of this organization has caused it to grow in membership and influence within a few years as have few national bodies of similar character. Effective national organization must rest partially on effective local organization. Interest aroused locally makes possible a yearly national gathering attracting several thousand persons from throughout the nation. The organization of local safety councils is the effective method of arousing local interest.

Casualty insurance companies carrying compensation insurance, through schedule rating of individual risks and through inspection service, have proved of inestimable assistance in accident reduction. Their effort has shown the great need for more definite analysis of accident causes as a basis on which the organized accident reduction movement may rest. Safety education in the public schools not only promotes safety habits in the most pliable years of life, but gives a groundwork of interest on which other phases of the organized safety movement may build.

III. SAFETY CODE DEVELOPMENT AND ENFORCEMENT

The National Safety Code Program, sponsored by the best engineering minds in the country and reaching into all states and all industries proposes standardization of codes and regulations. This ultimately must be of enormous cost benefit to builders and users of machinery at the same time that it insures uniform attention to all like hazards, promotes workable codes for jurisdictions which cannot afford to prepare their own, and consolidates the experience of the larger industrial states which have dealt with these engineering problems in many thousands of establishments.

The development and enforcement of safety laws and codes in the states has been a gradual process and has met with varying success in varying jurisdictions. Practically all the leading industrial states to-day are active in the development and enforcement of safety codes. The articles from such widely separated jurisdictions as Massachusetts, Pennsylvania, Ohio, Wisconsin and California are particularly interesting because they all illustrate the modern attitude of professional methods and helpful co-operation which exists with the enforcing agencies of the leading industrial states.

IV. SAFETY IN SPECIFIC INDUSTRIES

Almost every hazardous industry can point to its special safety problems and also to the specific methods which have proved successful in attacking these. Some occupations which were formerly among the most hazardous are now among the safest. New safety methods in one plant are quickly adopted in others, while in some cases, notably in the cement industry, or-

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ganized safety within the industry has resulted in remarkable accident reduction records. The articles on the eleven industries treated show how basic methods common to all safety work have been modified to meet varying conditions with uniform success.

V. ACCIDENT PREVENTION FOR CERTAIN HAZARDS

Whatever the industry, certain hazards are always to be found and these represent some of the common problems of safety workers wherever they may be. Mechanical power transmission equipment has been long recognized as one of the greatest potential accident makers and only the attention which has been devoted to guarding such equipment keeps the accident toll from this source comparatively low. Point-of-operation guarding with technique now less developed, represents the next great step in advance in mechanical guarding. But as many persons are probably injured from falls as from all mechanical accidents, and yet because of the simple nature of the accident comparatively little attention has been given to the hazard. Eye protection has been the subject of much research and nearly all the eyes lost in industry could be saved if the recommendations made in the article on that subject were rigidly adhered to. Education of the worker is here especially necessary.

Infection, mainly caused by disregard of simple precaution after minor injury, is a major cause of serious after-effect from accident. It can be readily guarded against. To protect workers from industrial poisoning is more difficult but just as effectively accomplished. Many of the newer industrial processes have brought with them industrial poisoning problems, which require effective research and effective administration for their

solution. Finally, among the articles treating industrial hazards is that dealing with the effects of poor illumination. It is interesting to know that good illumination will not only reduce accidents but provide a by-product of increased production at lowered cost.

VI. EDUCATING THE WORKER IN SAFETY

Most safety work, most guarding, most expenditures for safety go for naught unless the worker himself understands the safety problem, the causes of accident and his responsibility for accident reduction. It is probably not an exaggeration to say that fifty per cent of all industrial accidents would be prevented if the worker had safety actively before him. To arouse interest in safety is one thing, to sustain it another. Putting safety across to the worker must be done largely through the foreman who has been frequently called the key-man of industry and who certainly is when safety is concerned. When seventy-five per cent of the workers in industrial plants become actively interested in safety, accidents will be halved.

VII. THE RELATION OF SAFETY, COMPENSATION AND REHABILITATION

Compensation legislation has fostered the safety movement because of the financial aspects and because attention has been turned to the industrial safety problem through the discussion of compensation laws. In most states the administration of compensation and safety legislation is closely correlated, as is explained in the article on their relationships in New York State. One important phase of all such relationships is involved in getting the injured man back to work with least loss to him and to the em-

ployer. Finally, there comes the case where accident prevention fails, where compensation alone cannot restore the earning power of the worker, and where active rehabilitation work must

be undertaken. What a rehabilitation program implies and how it can be administered is described in the last article of this volume.

SPECIAL EDITOR.

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Industrial Accidents in the United States

By ETHELBERT STEWART

U. S. Commissioner of Labor Statistics, U. S. Department of Labor

THE machinery for collection of adequate and reliable reports on industrial accidents in the United States unfortunately does not exist.

In the first place six states having no workmen's compensation law do not report accidents at all. Other states report compensable accidents only, while from New Mexico we get only the report from coal mines. While it is quite generally agreed that an accident is an injury which results in the loss of time beyond the day or shift in which it occurs, compensable accident means an injury which entitles the injured to compensation in the state in which it occurs; hence each state has its own standard for compensable accidents.

The waiting period in the various states is by no means uniform, running from none at all in two states to three days in four states; five days in one state; one week in thirty states; ten days in four states; and two weeks in five states. It must be clear that with this diversity in the waiting period there is essentially nothing comparable as between the states when reporting compensable accidents only. According to Miss Outwater's accident table of the temporary total disability accidents, the disability in 9.2 per cent of the cases does not last beyond one day after the day of the injury; in 25.3 per cent of the cases the disability lasts three days; in 37.1 per cent of the cases, five days; in 46.9 per cent, seven days; in 56.2 per cent, ten days; while in the five states that have a two-weeks waiting period 65.5 per cent of the industrial accidents would not be reported as compensable.

In 1921 the Bureau of Labor Statis-

tics endeavored to get as complete a report from the states on all fatal and reportable non-fatal accidents as it was possible to secure. For the purpose of this article I have endeavored to secure returns from the states upon the same basis for 1923 and 1924. The results appear in the table on the following page.

The incompleteness of this table, to say nothing of the incomparability of the returns from the states as a whole, gives no flattering picture of the industrial accident situation in the United States.

We are not a cruel people, neither are we indifferent to human life and suffering. Let a city be burned or a district be flooded, and we pour out our money to the distressed as no other people in the world. It seems necessary that the situation be spectacular, however, before we become aroused. This is illustrated by our excitement over a coal-mine explosion and our utter lethargy over deaths and injuries in coal mines from falling roofs. The percentage of deaths and injuries in coal mines from explosions is almost nil as compared with those from falling roofs, but the larger numbers and the fact of greater negligence do not appeal to us. As a people we certainly like to go to the movies.

The table does not in all cases contain the coal-mine accidents, and the U. S. Bureau of Mines reports for coal mines show only fatalities. These were for 1921, 1987; for 1923, 2458; for 1924, 2381.

Again, some of the states report railroad accidents in intrastate service, but do not report interstate railroad acci-

NUMBER OF FATAL AND NON-FATAL ACCIDENTS AS REPORTED BY THE SEVERAL STATES
1921, 1923 and 1924

State	1921		1923		1924	
	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal
Alabama.....	144	4,155	...	....	...	....
Arizona.....	22	509	54	717	40	887
Arkansas.....	...	....	...	....	...	....
California.....	453	61,814	716	92,744 ¹	645	101,633 ¹
Colorado.....	151	13,753	168	15,194	140	17,373
Connecticut.....	96	22,800	...	....	...	....
Delaware.....	18	3,882	...	....	...	....
Florida.....	...	....	...	....	...	....
Georgia.....	82	11,690 ²	109	22,319	109	26,770
Idaho.....	63	4,564	57	3,237	83	3,523
Illinois.....	498	43,024	675	61,810	646	53,000
Indiana.....	263	34,133	268	54,582	274	48,730
Iowa.....	113	14,839	112	13,834	119	13,610
Kansas.....	71	6,240	72	10,071	84	10,890
Kentucky.....	120	16,789	108	23,892	97	28,030
Louisiana.....	...	....	...	....	...	....
Maine.....	49	12,778	64	16,311	38	14,168
Maryland.....	116	36,896	126	40,913	139	38,833
Massachusetts.....	296	53,017	330	64,560	336	61,640
Michigan.....	...	....	...	....	276 ⁴	27,451 ⁴
Minnesota.....	134	34,447	204	40,245 ⁵	123	36,123 ⁵
Mississippi.....	...	....	...	....	...	....
Missouri.....	...	....	...	....	...	....
Montana.....	83	3,421	81	5,048	87	5,702
Nebraska.....	30	11,326	30	16,162	35	15,000
Nevada.....	20	1,247	31	1,113	31	1,206
New Hampshire.....	10 ⁶	1,523 ⁶	13	1,434	19	2,442
New Jersey.....	282	27,754	290	40,002	283	47,958
New Mexico.....	16 ⁷	...	...	....	...	....
New York.....	1,177	293,292	1,665	345,180	1,927	369,781
North Carolina.....	...	....	...	....	...	....
North Dakota.....	9	1,296	11	1,654	13	1,809
Ohio.....	649	111,026	803	176,427	933	180,677
Oklahoma.....	85	22,779	...	34,908 ⁸	...	45,826 ⁸
Oregon.....	138	20,318	...	....	...	....
Pennsylvania.....	1,924	138,273	2,412	198,023	2,209	175,330
Rhode Island.....	24	2,952	...	....	...	....
South Carolina.....	...	....	...	....	...	....
South Dakota.....	23	2,701	18	3,455	17	4,518
Tennessee.....	96	17,093	90	25,008	...	....
Texas.....	308	94,256	253	86,482 ⁸	299	92,613 ⁸
Utah.....	91	9,932	...	....	...	....
Vermont.....	29	7,724	35	9,356	18	10,507
Virginia.....	133	5,327	...	....	...	....
Washington.....	287	19,729	398	31,081	385	39,270
West Virginia.....	429	20,398	501	28,269	729	30,608
Wisconsin.....	181	18,806	168	23,166	134	25,106
Wyoming.....	51	2,042	...	....	...	....
Total.....	8,764	1,209,151	9,862	1,496,197	10,268	1,531,104

¹ Subject to change.² Tabulatable accidents.³ March-December.⁴ Compensable.⁵ Estimated.⁶ Ten months.⁷ Coal mines only.⁸ Includes fatalities.

dents occurring within the state. Other states report these, although having no jurisdiction in compensation matters. The number of railroad employes killed in 1921 was 1446, those injured, 104,530. For the year 1923, 1940 were killed and 151,960 injured, and for the year 1924, 1479 were killed and 124,655 injured, according to the reports of the Interstate Commerce Commission.

In all of these reports there is some overlapping and duplication, and yet through it all there is the counter fact of lack of reporting of uncovered industries, and uncovered territories. We are, therefore, perforce thrown back upon the necessity of resorting to estimates, which is, of course, a confession that as a people we do not care enough about industrial deaths and injuries even to count them. Some three years ago the Bureau of Labor

Statistics committed itself to an estimate of 2,453,418 industrial accidents in the United States per annum where the injury resulted in loss of time beyond the day on which the injury occurred. It estimated that of these, 21,232 were fatal; 1728 resulted in permanent total disability, and 105,629 in permanent partial disability; while the accidents causing temporary total disability were estimated to be 2,324,829. The days lost as a result of these injuries were estimated to be 227,169,970 per annum, with a wage loss of \$1,022,264,866.

From the detailed table shown it would seem that accidents have been steadily on the increase, and that these estimates should be revised upward. The death toll is probably not under 23,000, and the non-fatal injuries 2,500,000.

The Need for Safety from the Worker's Point of View

By WILLIAM GREEN

President, American Federation of Labor

PROGRESS seldom comes with the simultaneous forward movement of a whole group or an undertaking. Usually some part is in advance of the others, and there is maladjustment until all can move forward in equitable co-operation. So in industry the material side of technical progress has been speeded up without adequate consideration of the human instrumentalities necessary to direct high technical organization. The machines of industry were first built and installed without a thought of hazards to those in charge of them.

Men, women and even children spent their working hours around unguarded machinery and when rush periods came or the day's work had passed the peak of high production and fatigue made the workers less wary, many an unnecessary accident brought individual suffering and loss as well as loss to the industry.

Control over machine guarding, work processes and other working conditions rests primarily with management. While the worker may express his views he does not have power of decision. The responsibility for compensating industrial accidents rests, therefore, upon the industry. This has become an accepted social policy expressed in our compensation legislation. The enactment of this legislation brought industrial accidents forcefully to management's attention through expense items in accounts. When accidents became expensive, industry began to consider accident prevention devices and methods.

The technical side of accident prevention is primarily a field for experts and technicians, but the problem of carrying any plan into effect makes

necessary the co-operation of wage earners. This co-operation can come only through an organized group. Here the union is the logical agency, for it only can offer the worker unwavering support. Putting a safety program into effect is not so simple as it sounds.

Often the rules prescribed for safety first mean doing things other than the speediest way. When management makes high quantity production paramount, the worker who follows safe practices finds himself penalized if not dismissed. Obviously then, co-operation must rest upon confidence and equality.

HUMAN WASTE IN INDUSTRY

An illustration of effective safety work organized on a democratic basis with the co-operation of trade unions, is the safety work of the safety committees of the United Mine Workers. These committees serve as an educational agency as well as an administrative agency for mine safety. The miner's work is ultra-hazardous. In 1923 there were 29,172 men injured in the anthracite mines. In 1924 there were 30,241 injured, nearly one-fifth of the total number employed in the anthracite industry in one year victims of accident and death. The loss of four million labor days a year by one hundred and fifty-eight thousand men in the anthracite industry through injuries and deaths alone is the loss to the industry. In the whole mining industry there were two thousand four hundred and fifty-two fatal accidents in the year 1923 and two thousand three hundred and eighty-one in 1924.

For the year 1921 in all industries the fatal accidents reported were eight thousand seven hundred and sixty-four

and the non-fatal one million, two hundred nine thousand, one hundred fifty-one. This, of course, does not include many unreported accidents, non-fatal accidents or data on those suffering from industrial diseases.

The picture of what industrial hazards mean in the terms of industrial waste is given in the following estimates from the *Waste in Industry Report* of the American Engineering Council:

In 1919 there occurred in all the industries of the United States about 23,000 fatal accidents; about 575,000 non-fatal accidents causing four weeks or more disability; about 3,000,000 accidents in all causing at least one day's disability.

The same report estimates the net waste due to negligence of health supervision in industry at one billion dollars. In addition, preventive measures bring social dividends of high value to the nation.

These figures of course do not disclose the full extent of industrial hazards for miners, for an industrial hazard comprehends disability by disease as well as by sudden injury. We cannot consistently urge one policy for accidents and another for industrial disease. Both are due to work environment. Both result in disability, differing only in rapidity of development.

Preventive measures and programs as well as compensation should therefore apply to both occupational disease and accidents.

To management the problem of industrial safety and hygiene is a problem of efficiency. Whatever interferes with stability of working force is industrial waste—an expense that adds to production costs.

The wage earner has more at stake in the industrial safety movement than any other group. His own physical and mental well-being is involved. The consequences to him are personal or irreparable. Naturally, therefore,

the first protest against conspicuous industrial hazards came from wage earners, and our protests found effect in compensation legislation and constructive efforts to reduce preventable injuries.

PREVENTIVE MEASURES

The principal methods through which safety work is carried on are safety codes, safe practices and technical advice on desirable working condition standards. For the fully rounded development of these methods, wage earners can make the invaluable contribution of the experience of the workman on the job. This contribution is necessary to assure practicability of recommendations. In serving in this capacity, wage earners should be representatives of the unions, which are the repositories of the work experiences of the craft for many years.

On the health side, the same inadequate consideration of the health of the workers in connection with changes in production processes exists. Chemical research has been making radical and comprehensive changes in manufacturing methods. Some of these changes have been put into effect without thought of the exposure of workers to industrial poisons. The new industrial hazards were discovered only through increasing sickness, and even in some cases through an undermining of the nervous system. Such carelessness on the part of management is bad industrial economy and constitutes a revolting social waste. Labor is seeking better and more accessible sources of information on industrial hygiene, as present agencies are inadequate.

In the fields of industrial accident and disease prevention, wage earners through their only representative agency, the trade union movement, have an immediate and vital interest and stand ready to help in every possible capacity.

Need of Safety from the Employer's Point of View

By MAGNUS W. ALEXANDER

President, National Industrial Conference Board, Inc., New York City

THE importance of accident prevention was recognized many centuries ago when Moses issued the injunction:

"When thou buildest a new house then thou shalt make a battlement for thy roof, that thou bring not blood upon thine house if any man fall from thence."

The problem of safeguarding the manual worker against accident was, however, primarily a product of the Industrial Revolution. Under the domestic and handicraft stages of industrial organization, the safety of craftsmen and apprentices was largely a matter of individual caution since they were, exposed to few employment hazards. The introduction of machinery brought with it new risks which were multiplied by the increased interdependence of the workers. The safety of an employe depended not only upon his own prudence and judgment but also upon the prudence and judgment of his fellow employes and upon the foresight of the employer in detecting the hazards inherent in the new mechanical devices.

In the early stages of the factory system, the interest of the employer in the protection of his employes was primarily humanitarian. The number of workmen in a factory was small. The employer was in many instances a fellow workman and, in any event, was in close contact with those in his employ. If a man was injured, the employer usually took personal charge of the case. He was fully cognizant of the special dangers of the occupation. In short, he was in a position where he could directly supervise his workmen

and insure the exercise of a reasonable degree of caution on their part.

The rapid expansion of modern industrial enterprise has added to the responsibility of the employer and has made close association with employes impracticable. The increasing intricacy of mechanical devices has multiplied industrial hazards and rendered necessary increasingly technical methods of accident prevention. The employer has been compelled to make use of a large number of subordinates in the protection of employes from the risks of industrial employment. The fact remains, however, that, while the organization of industry has changed and the employer is no longer able to supervise in person the safety work of his organization, employers are still moved by humanitarian motives and still maintain an interest in the physical welfare of their workmen.

But two factors have introduced a new element influencing the employer's attitude toward the problem of accident prevention, the element of self-interest. The first of these factors was the enactment of legislation designed to safeguard employes from avoidable hazards and to provide compensation for those who suffered injury. The state of Massachusetts passed in May, 1877, the first American law requiring certain safeguards and providing for factory inspection. This law was soon copied by other states until at the present time nearly every state in the Union has by legislation prescribed minimum conditions of safety in factory employment. The principles embodied in workmen's compensation legislation were first de-

veloped in the Accident Insurance Bill introduced in the German Reichstag in 1881, as a substitute for the existing Employers' Liability Law of 1871.

The law of 1871 was regarded as insufficient to protect the workman against the dangers of his calling and moreover imposed burdens of an irritating character upon the employer. The changes which the German legislation, finally adopted in 1885, wrought in the fundamental principles of employers' liability were adopted within twenty years by practically all of the states of Continental Europe and ultimately by practically every one of the American commonwealths.

This legislation, particularly the workmen's compensation laws, has stimulated employers to the realization that the prevention of accidents is a cheaper and more satisfactory solution of the problem than the payment of accident benefits. It may truly be said that the economic motive for safety provisions received a decided impetus in the compensation legislation. This legislation for the first time placed a definite monetary value upon the more common injuries suffered by workmen in various types of employment. The employer, having been shown the probable cost of such injuries, was stimulated to reduce these costs by proper attention to accident prevention.

The second factor influencing the employer's attitude toward the problem of safety has been the growing recognition of the importance of efficiency in production. The realization that accidents impaired that efficiency tended to increase the employer's interest in protective measures. The accident as a form of economic waste has been quite clearly established. The Bureau of Labor Statistics estimates that there are annually 2,453,418 industrial accidents in the United States, of which

21,000 are fatal. This vast loss in man power must be replaced and that replacement cost may range from \$10 to \$200 per individual. Moreover, accidents cause a temporary stoppage and readjustment of production with respect to which employers cannot afford to be indifferent. Finally, it is probable that failure to provide adequate protection against injury increases the employer's wage expenditure. No industry or individual establishment notoriously delinquent in its accident prevention policy can attract workmen without offering wages higher than those offered by competitors who provide employment of a less hazardous character.

WIDESPREAD RECOGNITION

The safety movement in the United States assumed a position of importance about 1907 when the iron and steel industry began to give considerable attention to its industrial casualties. During the period between 1907 and 1917, this industry as a whole brought about a reduction in the frequency rate of accidents of sixty-seven per cent and the severity rate measured by the number of days lost, declined sixty-two per cent. One large steel company estimated that between 1906 and 1920 the accident prevention program had saved 23,000 employes from serious disability and fatal accidents. It was also estimated that the savings resulting from this conservation of human life and energy had been sufficient to cover the entire cost of the safety movement including the installation of safety devices and to leave a sizable balance over and above all these expenditures. The demonstrated value of safety in the case of the steel industry brought to employers in other industries the significant fact that the conservation of man power, time and equipment through safety programs

had more than a humanitarian value.

Employers have not, in recent years at least, been unwilling to recognize their responsibility for the protection of their employes. Sometimes, however, a lack of knowledge as to the best methods to remedy unsafe conditions or doubt that safety devices and measures could overcome human carelessness have led to conservatism. It was necessary to show, as some of the large scale industrial enterprises have shown, that safety was possible of attainment and that it paid well in the lessened financial liability of the employer and in the increased production which safe methods made possible.

Executives everywhere are coming to recognize that safety is not a fad. As soon as the economic value of the safety program is fully understood, it will receive proper recognition in every industrial establishment. However, with all the feasible safety devices operating under the safest possible working conditions, large numbers of employes continue to be injured. The

employer is, therefore, not only confronted with the problem of safeguarding men through mechanical devices but must also show his employes that carelessness is to be feared and avoided. It is recognized that the careless employe is costly and undesirable and a menace to his fellow workers. The failure on the part of any worker to acquire the safety habit should be considered sufficient warrant for discharge.

No matter how sound in principle or how worthy of support a movement may be, it may develop characteristics or applications which impede its universal acceptance. There have been safety failures just as there have been business failures. Not all safety devices have proved practical. In some instances, perhaps, they have interfered with efficient production. But, in general, the employer views with increasing satisfaction the effectiveness of safety methods as a bulwark against the costly inroads of accidents and industrial casualties.

History of the Safety Movement

By LEW R. PALMER

The Equitable Life Assurance Society of the United States, New York City

When thou buildest a new house then thou shalt make a battlement for thy roof, that thou bring not blood upon thine house if any man fall from thence.—*Deuteronomy, XXII: 8.*

THE history of safety can properly be said to parallel the history of man. During the dark ages of his early development, the survival of the fittest and the law of self-preservation largely prevailed. His upward climb has continued to be a contest with danger—the mind and purpose of man contending with the conditions and forces of nature; conditions changing slowly at first, but, as knowledge begat knowledge, with ever-increasing speed.

Looking back over the path man has traveled, we find many milestones marking the way toward safety, all bearing witness to the same purpose—*conservation of life*. Standing even after the passing of the ages, we find the cave of prehistoric man; the multiple abode of the cliff dweller; the feudal castle, and the block house—mute evidence of the common thought—*safety*.

As the social order of civilization changed and became more and more complex, the problem of safety changed. To meet the mass element projected into the problem, we have applied science ("the arrangement and correlation of knowledge") and engineering ("the art of organizing and directing men and controlling the forces and materials of nature for the benefit of the human race"). These have proven to be man's most effective agencies of conservation.

As industries developed, multiplied and expanded into individual magnitude, an ever-increasing burden was placed upon man-power. The engineer responded to the call; developed engines and machines; lifted man to a higher plane; multiplied his powers a thousandfold, and created a new era. An era, however, fraught with many new and unforeseen hazards as by-products of progress; and again man called upon the engineer to protect him against the hazards incident to these very engines and machines that had contributed so much toward the increase of his productive capacity.

It would be difficult to develop our history of the safety movement on a strictly chronological basis. Many industries have worked out their individual problems more or less coincidentally. However, from the best information available it would seem that as an industry iron and steel can be justly credited with the first comprehensive effort to organize an entire industry, and can also be credited with originating the "American Plan"; that is, getting the man and management into the game and working for safety because they wanted to rather than because they had to. This industry as we find it in modern times presents many inherent hazards to life, which fact is no doubt responsible for the development of accident prevention methods in many plants of the industry as early as the year 1900. The focusing of thought and purpose upon the development of this special phase of plant management revealed the fact that, as we had been sadly negligent

in conserving our minerals, forests and other natural resources, so had we been woefully wasteful of the lives and limbs of our industrial workers. We began to realize that this annual toll of life was not the lamentable necessity we had believed it to be, but that, by the proper application of organized effort—purpose plus money—amazing reductions in accident frequency could be effected.

IRON AND STEEL ELECTRICAL ENGINEERS

It is a strange coincidence that to iron itself was given the obligation to act as the guiding element in the ancient compass, working in co-operation with the earth's magnetic field; and that some 4000 years later the Association of Iron and Steel Electrical Engineers was destined to point the way to industrial safety organization on a co-operative, scientific and engineering basis. From its inception, in the year 1907, this Association made accident prevention an outstanding feature of its activities. A safety committee was established for the purpose of studying accidents occurring in the iron and steel industry; particularly those incident to the application of electricity. This committee also developed the safety programs for the annual meetings of the Association, which became more and more a predominating feature of the conventions year by year. At the 1911 convention Reverend John McDowell was one of the prominent speakers on this subject. His empty sleeve bore evidence to the fact that in his boyhood days he had lost an arm in the mines of Pennsylvania. Speaking from the heart of a man, and for the spirit of God, his inspiring address did much to further stimulate the spirit of safety throughout the iron and steel industry. The following lines quoted from Dr.

McDowell's address can well be said to form the foundation of the Gospel of Safety, and should unquestionably occupy an honored place in the history of the safety movement:

The purpose to save life is the noblest of all purposes;
It embodies the highest ideal of humanity;
Conserves the best asset of the nation;
Provides the best protection for the nation;
Creates the real glory of the nation;
It incarnates the only spirit which offers a solution for all our modern problems, namely, the spirit of democracy and brotherhood;
It answers in the affirmative—we are our brother's keeper, and, more than that, we are our brother's brother.

The officers of the Association of Iron and Steel Electrical Engineers, having received such wholehearted co-operation in this pioneer effort toward the development of organized safety, were encouraged to extend their endeavors toward establishing a separate safety organization, national in scope, that could better serve as a co-ordinating agency and a general clearing house for all phases of accident prevention. To this end it was decided to hold a joint conference at its next convention, believing that the importance and magnitude of the subject precluded its being organized within the Association.

With the object of obtaining the active participation of all agencies and individuals interested in accident prevention, a personal survey was made of the field by a representative of the Association, who traveled some four thousand miles and returned with the favorable report that all were in accord with this suggestion. The success of such a joint meeting was unquestionably assured.

The conference was called in Milwaukee, Wisconsin, September 30 to

October 5, 1912, and a comprehensive program was developed, including the following sessions: Federal, States, Mines, Transportation, Manufacturers, Allied Associations, and Iron and Steel.

As further evidence of the high ideals which dominated the safety movement, the prayer offered by Dr. Edwin A. Steiner, Professor of Applied Christianity, of Grinnell College, is quoted:

May our consideration of the safety of labor and the toiler be rewarded by a higher respect for humanity as a whole, a greater regard for law, a purer and deeper and higher patriotism, and may this great country continue to be the beacon to the world, lighting toward liberty and toward progress. May the work of this Congress be a contribution toward that end.

Thus was laid the cornerstone of a national institution, its emblem the White Cross of Universal Safety.

The following resolutions were adopted at this convention:

Whereas, The Association of Iron and Steel Electrical Engineers regarding as worthy of particular attention the hazards to life involved in electrical operations in steel mills, and appreciating the importance of the general safety movement not only in electrical engineering, but also in the steel industry as a whole, and in all the other varied and important industries of our country, and having met with such prompt co-operation in their proposals to establish a national organization devoted to securing increased safety to human life, have reached the conclusion that such an organization can best be brought about by action at this joint meeting of the Association of Iron and Steel Electrical Engineers and the Co-operative Safety Congress, and it is, therefore, hereby

Resolved, That the President of the Association of Iron and Steel Electrical Engineers be requested to take the first steps toward the formation of a national organization for the promotion of safety to human life by appointing a Committee

on Permanent Organization, which shall contain representatives of the Federal and State Agencies already established to supervise conditions of safety in our industries, and shall also contain representatives from the Mining, Transportation and Manufacturing Industries of the United States, and be it further

Resolved, That the Committee so appointed shall be and hereby is authorized by this Congress to organize and to create a permanent body devoted to the promotion of safety to human life in the industries of the United States; this Committee to have authority to call future Congresses of Safety, increase its membership if it so desires, and to do such other acts as will promote the object for which it is established.

The Committee appointed consisted of the following members:

- Dr. Charles P. Neill, U. S. Commissioner of Labor.
- Dr. Joseph A. Holmes, Director, Bureau of Mines.
- Mr. Chas. C. McChord, Interstate Commerce Commission.
- Mr. F. W. Houk, Commissioner of Labor, Minnesota.
- Dr. Lucian W. Chaney, Department of Commerce and Labor.
- Mr. H. M. Wilson, Bureau of Mines.
- Dr. M. J. Shields, National Red Cross.
- Mr. C. W. Price, Wisconsin Industrial Commission.
- Mr. James T. McCleary, Iron and Steel Institute.
- Mr. John Kirby, Jr., National Association of Manufacturers.
- Mr. R. C. Richards, Chicago and Northwestern Railway.
- Mr. C. L. Close, U. S. Steel Corporation Safety Committee.
- Mr. F. C. Schwedtman, National Association of Manufacturers.
- Mr. David Van Schaack, Aetna Life Insurance Company.
- Mr. R. J. Young, Illinois Steel Company.

Mr. Lew R. Palmer, Association of Iron and Steel Electrical Engineers.

This records the development of a national humanitarian movement growing out of the pioneer work done in the iron and steel industry.

OTHER ORGANIZED SAFETY MOVEMENTS

The organization, development and accomplishments of the National Safety Council furnishes an interesting page in the history of our national industrial development. From the aforementioned sixteen charter members has grown an organization that to-day numbers more than four thousand in membership, including the majority of the large industrial organizations of the United States.

The effectiveness of organized safety

throughout the country has been stimulated, in a large measure, through the activities of the National Safety Council.¹

The banner accomplishment in industrial safety can well be credited to one of our large steel companies, whose remarkable record is indicated in the chart below:

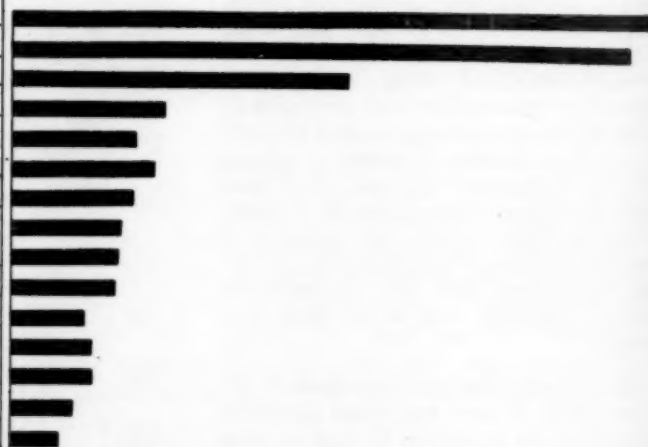
Among the pioneer safety men of the iron and steel industry we find recorded the names of the late Colonel Raynold C. Bolling (for whom Bolling Field was named), Messrs. Charles L. Close, R. W. Campbell, Arthur T. Morey, R. J. Young, C. W. Price, W. H. Cameron, John R. Brownell and A. H. Young, whose combined achievements have done much toward changing an industry originally deemed one

¹ See *Organizing for Safety Nationally* by W. H. Cameron. Page 27. THE EDITOR.

* LOST-TIME ACCIDENT FREQUENCY PER 100 MAN YEAR OF ONE OF OUR LARGEST STEEL COMPANIES

Years 1911-1925

Year	L.T. acc. per 100 man year
1911	16.01
1912	15.58
1913	8.48
1914	3.80
1915	3.15
1916	3.66
1917	3.00
1918	2.81
1919	2.72
1920	2.68
1921	1.88
1922	2.10
1923	2.09
1924	1.52
1925	1.28**



* Lost-time accidents are accidents resulting in one or more days' loss of time.

** Estimated rate based on nine months' record.

Note.—92 per cent reduction.

of the most hazardous, into an industry which to-day is credited with the lowest accident frequency of any major industry of this country. These records, developed in the individual companies and plants, have not only effected great savings of life and limb within these companies and plants, but have also served as pacemakers to a multitude of plants throughout the country as a whole.

Coincident with the independent development of safety within the industries of this country, there was being transplanted from Europe another agency of life conservation—the "Safety Museum." In the American Museum of Natural History, New York City, was staged, in 1907, our first adaptation of the exhibit method of education in safety, under the auspices of the American Institute of Social Science.

From this display grew the American Museum of Safety, which was eventually incorporated in 1911. Splendid achievements have been attained by this, our first safety museum, under the able direction of Mr. Arthur Williams as president. The educational exhibits developed and medals of award issued under the auspices of the American Museum of Safety have done much to stimulate interest in life and health preservation.

Transportation, recognized as one of the greatest agencies in the advancement of civilization, has ever carried with it a life hazard. The caravan of ancient days, and the primitive ships of the early Phoenicians, were exposed to many dangers similar in nature to those that form the life hazard confronting our common carriers of to-day.

RAILWAY SAFETY MOVEMENT

The phenomenal development of our steam railroads in this country is aptly termed "the marvel of the age." As

regards the history of safety in this industry, it seems fitting to quote from an address presented at the recent Congress of the National Safety Council by Mr. Carl R. Gray, now President of the Union Pacific System, the first railroad to complete the iron trail leading to the far Pacific:

As far back as 1833, George Stephenson of England made the suggestion of the steam whistle on the locomotive as a means of preventing accidents.

In 1851 the first telegraphic train order was issued by Charles Minot, General Superintendent of the Erie Railroad.

In 1868 the Westinghouse airbrake was successfully applied, and in 1870 its adoption was begun.

In 1883 standard time was adopted on United States railroads. Prior to this, as many as 48 standards of time were recognized.

In 1885 the first test of the automatic coupler was conducted under the auspices of the Master Car Builders' Association.

In 1893 there was passed a Federal Safety Appliance Law, requiring power brakes, automatic couplers, side and end hand holds, "for greater security to men in coupling and uncoupling cars."

In 1903 the first steel passenger car was constructed.

The earliest form of block signaling was operated in England long before the telegraph was invented. At each station was erected a high mast on which a huge ball could be raised and lowered. When a train left a station the ball at that station was raised to the top of the mast. In this way the trains were authorized to proceed from one station to the next.

From this system was later (about 1863 or 1864) developed the manual controlled block system, by which spacing was accomplished by telegraphic signals, between contiguous stations and entirely independent of any other method of protection. The controlled manual system variously known as the Staff, Tablet and Lock and Block, was first used in England in 1874 and in this country on the New York Central Railroad in 1882.

The first automatic signal system using electric track circuit and a disc type of signal was patented in 1870 by Dr. William Robinson, an American, and installed for the first time in 1872 at Kinzua, Pa., on what is now the Pennsylvania Railroad.

Thus it will be seen that, despite the absence of any organized safety movement, railroad officers, locomotive and car builders and railway supply manufacturers were continually experimenting to discover things which would make for safety of operation.

When railroads were new, it was the passenger, and the passenger alone, for whose safety any fear was expressed.

As Mr. Gray had said, the railroad operator of the past concerned himself mainly with what he considered his first obligation—the safety of the public. How well he has fulfilled this obligation is evidenced by the following chart showing the remarkable reduction in casualties resulting from collisions:

This indicates a reduction of 81 per cent in seventeen years, or a saving of 85,005 casualties on a cumulative basis for the period.

The figures from which this chart was developed were taken from the railroad accident records of the Interstate Commerce Commission, of which accident records it has been truthfully said that no other industrial group has been recorded with equal completeness for so long a time—a contribution to the cause of safety of inestimable value.

The American Railway Association, throughout its many sections, and particularly its Safety Section, has exerted a persistent effort to safeguard the lives of the more than two million employees now included within this industry, as well as the many millions of passengers being carried annually. Its spirit of life conservation is illus-

TOTAL CASUALTIES RESULTING FROM COLLISIONS—STEAM RAILROADS

For Years 1907 to 1924 Inclusive

Year	Total Casualties
1907	10 317
1908	8 126
1909	5 737
1910	8 198
1911	7 430
1912	8 327
1913	8 488
1914	6 163
1915	5 957
1916	4 211
1917	5 465
1918	4 950
1919	4 169
1920	4 023
1921	1 969
1922	2 708
1923	2 502
1924	1 924
TOTAL	100 701



trated by the resolution adopted at the Fourth Annual Meeting of the Safety Section:

Whereas, The records of the Interstate Commerce Commission as given in the report of the Committee on Statistics indicate that casualties to persons on the railroads of the United States can be reduced 35 per cent by the end of the year 1930 and that such a reduction should be adopted as a definite goal of the Safety Section, be it, therefore,

Resolved, That the American Railway Association, Safety Section, in annual convention assembled at Salt Lake City, Utah, June 24, 1924, hereby accept the report of the Committee on Statistics and adopt for the Safety Section a goal calling for a reduction in casualties to persons by the

end of 1930 which will be equivalent to 35 per cent.

The Careful Crossing Campaign, inaugurated June 1, 1922, by the Safety Section of the A. R. A. is further evidence on the part of the railroads of their purpose to save life.

What might well be termed the banner accomplishment in railroad safety as applied to an individual railroad is depicted by the chart which follows:

According to Interstate Commerce Commission records, this road has led all major railroads of the country in the lowest accident frequency for the past five years.

E. H. Harriman said: "The way to do

I. C. C. REPORTABLE CASUALTIES PER 100 EMPLOYEES ON ONE OF OUR LARGEST RAILROADS

Years 1914-1924

Year	Average no. of emps.	Total casual- ties*	Tot. cas. per 100 emps.
1914	18 803	1 529	8.13
1915	20 982	1 332	6.35
1916	23 847	1 772	7.43
1917	27 436	2 101	7.65
1918	28 659	1 689	5.89
1919	31 095	1 487	4.78
1920	34 336	1 592	4.64
1921	24 104	553	2.21
1922	24 789	444	1.79
1923	27 365	371	1.36
1924	26 685	225	.84



* Fatalities and injuries resulting in three or more days' loss of time.

Note.—Total employees, 1915-1924, inclusive.....	269,278
Estimated casualties per 100 employees, 1915-1924, inc., at 1914 rate (8.13)...	21,892
Actual casualties, 1915-1924, inc.....	11,546
Reduction in casualties, 1915-1924, inc.....	10,346
90 per cent reduction in ten years.	

a thing is to *start* something." He can justly be credited with "starting something" in the field of railway safety, for surely the splendid organization and equipment developed and applied under his masterful leadership have played no small part in keeping the Union Pacific and Southern Pacific in first and second rank of all Class One railroads of the United States, on the basis of lowest accident frequency, for more than ten years.

George Westinghouse, inventor of the air brake, made possible steam and electric transportation as we find it to-day. Great as was this achievement, far greater credit is due for the innumerable lives saved through the application of this one commercial device, for it required not only inventive genius, but indomitable will and purpose to insure recognition and application of the air brake. When Westinghouse endeavored to interest Commodore Vanderbilt, head of the New York Central System, in his device, Vanderbilt asked: "Do you mean to tell me that you propose to stop a railroad train running at full speed with nothing but air!" Westinghouse replied, "Just that." Vanderbilt turned to his secretary and said, "Show this lunatic out and never let him trouble me again."

Unknown to but a comparative few is the obscure figure of the late "Father" (Lorenzo A.) Coffin, whose record of accomplishments for railroad safety was first written in the records of the Steam Railway Section of the National Safety Council at its 1924 Congress in Louisville. This, in brief, is as follows:

In 1881 Coffin was appointed right-of-way agent for the Des Moines and Fort Dodge Railroad, which was then being extended to Ruthven. One day he found it necessary to ride a freight train. Before the end of the trip the hind man went in to

make a coupling and had his last two remaining fingers crushed, leaving him totally incapacitated. This mishap sickened Coffin, but the next day he boarded another freight train in order to learn first hand from the men themselves the causes of railway accidents. Later he was appointed a state railroad commissioner. He still continued to ride freight trains until every railroad man in Iowa knew the kindly, grizzled face (he was then past 60) of "Father" Coffin as they called him.

The Iowa laws required investigation of accidents to passengers, but not to railroad men, so Coffin made this his job, and as a result found that the greater number of railroad men were killed by falling from cars, and the next greater number were killed in coupling cars.

When Coffin mastered all of the facts he wrote a letter about the railroad slaughter and sent it to all religious and family newspapers. He invited himself to all railroad conventions to talk on his favorite topic. He attended the famous Burlington brake trials in August, 1886, and he was the only railroad commissioner who stayed until the end. Undaunted by repeated failures, he rejoiced with Westinghouse when finally a world-famous triumph was won for the air-brake, and Coffin wept for joy when he saw a 50-car train thundering down a grade stopped within a distance of 600 feet.

He drafted the first safety appliance act ever written. It was passed by the Iowa Legislature and immediately signed by Governor Boise. The Interstate Commerce Commission recommended a law requiring automatic couplers and air-brakes. Coffin had a bill already drafted, which D. B. Henderson introduced in the House and W. B. Allison in the Senate. After a four years' fight, with Coffin on the job every day, the bill was signed by President Harrison on March 3, 1893.

The late Ralph C. Richards, beloved by all who knew him, is recognized as the father of organized safety as applied to the railway field. In his Milwaukee address, in 1912, he generously gave credit to his friends for assistance in

developing this work on the Chicago and Northwestern Railroad. He stated:

As I have often said, the Northwestern is the best railroad, and therefore it started the safety movement first. After we had started it we found, very much to our surprise, that the Illinois Steel Company had been doing this kind of work for years before we commenced it, and ever since then I have been stealing Illinois Steel thunder, and I have got a lot of good things from the Illinois Steel people, for which I want to publicly express my thanks and appreciation.

WIDESPREAD SAFETY MOVEMENTS

Our marine safety has, in the main, been handed down to us from the early mariners of other countries. It stands to-day as the result of the application of rules, devices and equipment controlled and supervised by governmental agencies.

One of the outstanding contributions to safety to life at sea is the present-day application of the wireless, made possible through the scientific discoveries of Maxwell (1865), Hertz (1887), Branly (1890) and Marconi (1894). The latter's early experiments enabled him to perfect wireless apparatus to a point that insured its commercial value, and to him is credited the first wireless signal ever telegraphed across the Atlantic. How many rescues at sea have been made possible through this wonderful gift of science is difficult to determine. Surely the number of lives saved runs into the thousands. When it is realized that from the year 1829 to the year 1924, inclusive, there were approximately sixty-nine thousand lives lost at sea in major disasters, the possibilities for the future utilization of wireless seem astounding.

The Marine Section of the National Safety Council was launched at Buffalo in September, 1923, and from its records we learn that in some cases, where isolated units have come under in-

dustrial supervision, marine safety has, to a limited extent, been developed on an organized basis.

The automobile seems to bear out the principle that the greater the economic value of a utility, the greater its initial cost in life and limb. Electricity, the universal servant, had scarcely been synchronized with our code of safety when another juggernaut was put in motion under the guise of economic necessity. Only a few pages are as yet written of this new phase of our problem, but, sad to relate, mainly in the blood of men, women and little children.

An aggressive effort toward the elimination of such automobile accidents, as well as other public accidents, is being made by the National Safety Council, in co-operation with other agencies having a common interest in this field of safety. Local Safety Councils, affiliated with the National Safety Council, have been established in more than one hundred of our largest cities throughout the country, and are the outposts of this, our present-day, major offensive against preventable accidents.

Perhaps the most important event to be found in our current history of public safety is the National Conference on Street and Highway Safety, called by Secretary Hoover in December, 1924.

Air transportation, our most recent "home-grown" product, promises to eclipse all competitors for the expression of the spirit of our day and age—*speed*. The beautiful Curtiss "Bluebird" has just recorded her 302 miles per hour, and her sister, the "Blackbird," has outdistanced her foreign cousins in a recent world-record flight. Our earnest prayer is that the same splendid qualities of engineering that made this wonderful accomplishment a fact will insure the greatest possible

degree of safety in what bids fair to become one of man's greatest achievements. It is hoped that proper governmental regulations will keep pace with this, our newest industry, protecting against unnecessary loss of life through careful licensing of pilots and their ships of the air.

Other industries have contributed in a commendable way to the effort that has made possible the success of our "American Plan" of accident prevention, but mention of these industries is precluded by the limited space allotted to this article. The good work done in the mining industry should, however, not be overlooked. The Mines Safety Association, which later became the Mines Section of the National Safety Council, was organized about 1911. Among the pioneer leaders in this field were the late Dr. Joseph A. Holmes and Mr. Herbert M. Wilson, both associated with the U. S. Bureau of Mines; also the late Mr. Thomas Lynch, of the H. C. Frick Coke Company, who was one of the original directors of the National Safety Council.

The electric mine safety lamp, made possible through the inventive genius of Thomas A. Edison, has saved many thousands of lives, and this contribution warrants the gratitude of countless homes that to-day would otherwise be shrouded in sorrow.

The Portland Cement Association also deserves an honored place in safety history. Through a very complete analysis of its accidents and the stimulation of active interest in safety contests, this Association has made a splendid contribution to the cause of accident prevention.

Insurance has made its influence felt in the field of safety. Early records of accident causes emanated from the files of insurance carriers, and Doctors Frederick L. Hoffman and Louis I. Dublin are benefactors in this branch,

as well as in many other branches, of life conservation. Among the insurance men who have so ably assisted in the development of accident prevention methods are: Messrs. David Van Schaack, Carl M. Hansen, David S. Beyer, H. W. Forster, J. M. Eaton, C. E. Pettibone, A. W. Whitney and Dr. A. D. Risteen. The insurance companies have contributed generously to the financial support of the safety movement, and this support will justify itself manyfold. At the present-day wastage, it is costing the insurance companies—or, more strictly speaking, the policyholders—more than \$200,000,000 per year in accident losses, 50 per cent of which can be saved through greater effort along co-ordinated lines.

The safety engineer has claimed, and still maintains, that the purpose to reduce accidents and save lives did not originate in this country through governmental application of compensation. A reference to dates is only necessary to prove the prior claim of the preventionist. No one disputes the fact that merit-rating compensation has been of assistance to the safety department in keeping the management sold to the advantages of organized safety, but this was by no means the first talking point as regards date or effective value.

According to Mr. John R. Commons, "the highest American authority on the subject of Workmen's Compensation for industrial accidents" was the late Mr. E. H. Downey. Those who knew him and his work in Pennsylvania do not hesitate to credit him with having exerted an influence that resulted in the saving of many lives and the prevention of a great many injuries.

THE LEADERSHIP OF JUDGE GARY

The human side of safety has been the dominant motive of the safety

movement, and as a result our industries have been raised from the realm of mere profit and production—have been humanized. Such progress could not have been made without leadership. This leadership is personified in Judge Elbert H. Gary, who represents, perhaps more than any other man, our American-made industry—iron and steel—the pioneer in organized safety. Judge Gary's inspiring leadership has been largely instrumental in placing this industry in the front rank of industrial safety, and he can well be considered the foremost figure in the safety field to-day. His humane spirit is indicated by an early record of his appeal for the adoption of organized safety within the U. S. Steel Corporation. Speaking before his board of directors, he said, "You perhaps do not realize the importance of this matter as fully as we who have given it our closest consideration, but, gentlemen, it's the *right* thing to do. If you will back us up in it, we'll make it *pay*."

That it was the *right* thing to do is proven by the fact that since 1906 more than 40,000 men have been saved from serious and fatal injury in the operations of the various subsidiary companies of the U. S. Steel Corporation; and in a ten-year period more than

250,000 men have been saved from injury causing the loss of more than one day's time.

That it *paid* is evidenced by the fact that reduced casualty expense has more than balanced the added cost incident to safety.

Our industrial safety problem seems, in the main, fairly well in hand, with the construction and mining industries having first claim for our assistance. The railroads have made a good start with an 11 per cent reduction in I. C. C. reportable accidents for the year 1924, but there is still much to be done before their goal is reached.

Public safety to-day constitutes a far greater problem, and our hope of the future lies in the development of a national senior advisory council made up of such men as Judge Gary and the Honorable Herbert Hoover, who have already proven their value to the life conservation movement. Unquestionably, the dynamic power of the combined organizing ability and spirit of accomplishment of such men, through the co-ordination of every available agency applicable to the common purpose—*universal safety*—would, in less than five years, effect a saving of more than 50,000 lives annually, 40 per cent of which would be the lives of children.

Does Accident Prevention Pay?

By G. A. ORTH, LL.B.

Manager, Safety and Claim Departments, American Car and Foundry Company,
New York City

THE subject of accident prevention may be considered from two points of view: (1) the economic, and (2) the social.

Economically, the prevention of accidents means the proper functioning of an industrial organization for the production of goods.

Socially, the prevention of accidents means the safeguarding of the health and lives of the members of the community for the common good.

Now, while the question, does accident prevention pay, is most generally applied to the economic side of the subject, it will be found that it applies just as pertinently, and for the same reason, to the social side. For every social advantage is an economic gain. So that on both sides the answer to the question is the same, and that answer is a decided affirmation. The prevention of accidents pays economically and pays socially. It is profitable alike to the organized factory and to the organized society.

This conclusion has been definitely established within the last twelve years by experienced employers of labor, on the one hand, and by the ablest political economists, on the other. Any other conclusion, it will be found, permits of every possible offence, and admits of no rational defence.

In this short paper, I do not propose to go at length into every phase of the subject. I shall deal with it mainly from the economist's point of view, and from a personal experience of accident prevention in one of the largest industrial plants in the country, parts of which are admittedly engaged in

hazardous work. I refer to the American Car and Foundry Company.

I will begin my consideration by positing the proposition that: Every business enterprise is essentially an enterprise in either the production or the distribution of goods, for the purpose of making profits. From this, it follows that every aid to production or distribution is an economic gain, and must tend to increase profit-making power.

ACCIDENT PREVENTION AS A PRODUCTION FACTOR

Now the principle I wish to establish is that accident prevention is an essential factor in both production and distribution. I will leave out the matter of distribution and deal with production only, though my argument applies to both. I affirm that accident prevention tends to increase the quantity and quality of the goods produced, and, therefore, the amount of the profits made. In other words, I contend that accident prevention, like production, is a business proposition, and, as such, should demand and obtain equal consideration.

Hitherto, the two chief factors considered in a producing organization have been material (including machinery) and personnel (including organization). To these I would now add a third factor, namely, accident prevention. Accident prevention directly affects both the material and the personnel; and it affects them in four directions:

- (1) *Increased Production*
- (2) *Decreased Overhead*

(3) *Decreased Labor Turnover*(4) *Saving in Money Compensation*

(1) Production is increased by accident prevention by conserving the energy of the workers, both in physical fitness and in time, for the purpose for which that energy is employed. It prevents the dissipation of any portion of that energy through accidental physical disability, loss of time, loss of power in replacement. It keeps constant the stream of force which has been canaled for the purpose of turning the wheels of the producing mill. Anything which stops the flow or diverts the current of that stream, lessens productive power. Anything which keeps it in its steady course, increases productive power. It follows, as a corollary, that a system, either of appliances or organization or of both, which would eliminate accidents, must be a paying system.

(2) Overhead is decreased by accident prevention in substantially lessening both the cost of insurance and the cost of compensation. But there is a further decrease. The cost of accidents is far more than the cost of compensation to the injured worker. The loss in time due to the disorganization which follows an accident, the delay in "speeding up" the plant afresh, represent losses not easily calculable in figures, yet they usually end in loss of often many hundreds of hours for which there can be no return. These working hours are utterly wasted, so far as production is concerned. Accident prevention avoids such a loss, and this is a definite gain in overhead decrease. It, therefore, pays.

(3) Labor turnover is a non-productive expense. Accident prevention decreases that expense. The absence of workers due to accidents compels a change in personnel. A change in personnel means loss of time and loss in

efficiency. Loss of time and loss in efficiency are non-productive expenses. Accident prevention eliminates these expenses. It, therefore, pays. All accidents disrupt the morale of any organization of human beings, especially one of a hazardous nature. Accident prevention keeps the working army in the even tenor of its way, preserves its morale, and saves the cost of recruiting and re-drilling. It, therefore, pays.

(4) Money compensation is, of course, saved by accident prevention. That is obvious. The employing organization may insure itself against such a loss, but the cost of insurance is, *per se*, a non-productive expense. It should, therefore, be lessened and avoided as far as possible. Accident prevention does lessen this expense, and lessens it very substantially. Accident prevention is in itself a form of insurance. It may be costly, but the cost is far less than the cost of the premiums charged by insurance companies. The American Car and Foundry Company spent \$1,000,000 for accident prevention in fourteen years. It saved approximately \$2,700,000 by doing this. The U. S. Steel Corporation expended \$9,763,063 in ten years for accident prevention. It has been calculated that it thereby gained \$14,609,920. It, therefore, pays.

Since accident prevention is thus so desirable, how can it be established on a basis where its profit-making possibilities shall fructify?

This is an important question, and demands the most thoughtful consideration we can give it. Speaking from my own experience in connection with the American Car and Foundry Company, I have come to the definite conclusion that any sound consideration must be based on the assumption that accident prevention is a problem in production. As such, it is a subject

matter which must be dealt with primarily by the head or heads of the organization. It must be envisaged and related to the organization as a whole by those in authority who are responsible for the well-being of that organization.

First and last, the problem is, as I have pointed out, a business problem; for on its solution depends the loss or gain of large sums of money. How to save or gain that money is properly the function of the guiding men of the industrial institution.

It costs money to make money, and the outlay which accident prevention necessarily compels, must not only receive the whole-hearted sanction of these men, but must be so directed by their personal guidance that it shall make the proper returns, along lines of least resistance.

ENLISTING THE WORKER'S CO-OPERATION

The American Car and Foundry Company has realized this in all its implications, and it has acted accordingly. Apart from the appliances and devices for guarding and insulating dangerous places and machinery, which the company has installed at great expense, it set itself the duty of enlisting the services of its entire force in a co-operative movement which has accident prevention as its high purpose and goal. This movement is of the utmost importance to the realization of the efficient working of any system of accident prevention. For without the co-operation of the workers, accidents will happen, be the mechanical appliances never so perfect.

Now to bring this about means that the workingmen must be educated and trained in habits of thoughtfulness and carefulness. This is not always easy to do; but the intelligence and loyalty of the American worker may be relied

on. Once wisely elicited and conserved, these spiritual qualities may be a material asset of incalculable value.

When the worker sees the heads of the organization taking a personal interest in the protection of his life and limb and in the safeguarding of his physical well-being, he will be quick to respond with a like attitude towards the organization he is serving. He may further be relied on to appreciate the efforts made in his behalf, when he is himself asked to take his part in realizing the hopes and aspirations of his employer.

The American Car and Foundry Company has proceeded along these lines. Under a so-called Safety Engineer (a man who should be not only a mechanic but one gifted with the power of mixing with workingmen and still receiving their respect), five of the shopmen in the various plants are selected to act as a Committee of Safety, for the period of three months. The duties of this committee consist in inspecting the safety appliances to see that these are in good order; to warn their fellow-workers of any dangers they are carelessly or thoughtlessly courting in their work; to report to the Safety Engineer any matters requiring attention, and to submit suggestions for improving safety devices and spreading the Gospel of Safety.

The members of this committee are changed every three months, so that all the workingmen of the plant have an opportunity to serve on it, and contribute their share of mind and heart to the general well-being of the entire organization. Experience has shown that this opportunity to exercise themselves on a higher plane and demonstrate their ability in a semi-official capacity is one which is keenly desired and enthusiastically fulfilled by all.

In this manner, a working staff of safety inspectors and safety educators has been obtained which could not otherwise have been got together, except at a very high cost. And even then, with far less realization of *esprit de corps* which now obtains through the influence of the members of the committee on the entire body of workers. This *esprit* is further maintained by safety literature posted, week by week, on the bulletin boards at all the company's plants. Here is a letter written by Vice-President W. C. Dickerman, who is in charge of operations, and addressed to the Company's plant managers:

Our safety organization has set for itself a very high goal in the direction of accident prevention—not to be satisfied until it is able to say that not a single accident, which by human foresight or organization could have been prevented, has taken place in our plants. It is a high aim, but with a strong determination and the whole-hearted support and co-operation of all plant-managers, superintendents and foremen, our safety organization will succeed. I am completely in accord with the "Safety-First" proposition, and I shall be glad if you will give the same thought to accident prevention that you now give to production.

In this manner, the workingmen themselves are their own accident preventers. Every man in the plants who is working at a machine, or smelting furnace or oven, has been dedicated to the service of safety. He is enthusiastically interested in outdoing a rival industrial organization in perfecting accident prevention. He is, therefore, not likely to be the victim of an accident if he can help it; and in eighty-five per cent of cases of accidents, there was a time when he could have helped it. The thoughtlessness and carelessness of the men are now changed into thoughtfulness and carefulness.

RESULTS BALANCE OUTLAY

It is often urged that money expended for safety appliances and the salaries of safety engineers for the prevention of accidents, is money uselessly spent because it is apparently non-productive—is an expense against which there is no "offset"—is, in a word, a dead loss. That argument can no longer be maintained. I have shown that such an outlay is more than balanced by increased hours of production in conserving the worker's physical ability; by preventing dislocation of the organization; by maintaining the morale of the workers; and by avoiding the loss in time and wages in training fresh hands. I contend, and my experience bears me out amply, that the "dead loss" is far greater in accidents than in the prevention of accidents.

But, as we keep on paying more and more attention to the safeguarding of the workingman's life and limb, we shall assuredly evolve a less costly system than now obtains, and in time reach a stage when we shall be as efficient in maintaining a factory's "life" as we are in maintaining a factory's product. Indeed, the one means the other.

Every investment of capital necessarily calls for an investment in human life. It is not possible to get dividends from the one without paying for the skill and labor of the other. Indeed, at bottom, every investment depends for its returns on the human factor alone. Is there any stronger or more convincing argument than this for the prevention of accidents to this human factor? I know of none. Your money would be so much dead metal, and your plant mere bricks and steel without the worker's wizardry—your own wizardry included—to transmute these into living values. It thus becomes a matter of the first consideration to conserve

and preserve, at all cost, the human factor in your industrial organization.

There is, finally, a social or, I should say, a humanitarian side to this policy; and it is a side which every employer of labor should never fail to bear steadily in mind. A monetary payment for an accident or a life lost in the service of an industrial plant is no true offset to the injury suffered or the misery entailed. No money can compensate for these sufferings. Accident prevention alone can and will do away with this suffering.

Our economists have, of late years, come to realize that the cost of production of any article is not all represented by the cost of the material and the wages and overhead paid. There is still a further cost, not possible of being set down in actual figures—what they call the human cost. By that is meant the pain and suffering experienced by the worker under the trying conditions in which the article is produced. That cost is not included by the manufacturer in the prime cost of his article, because he thinks he has not paid for

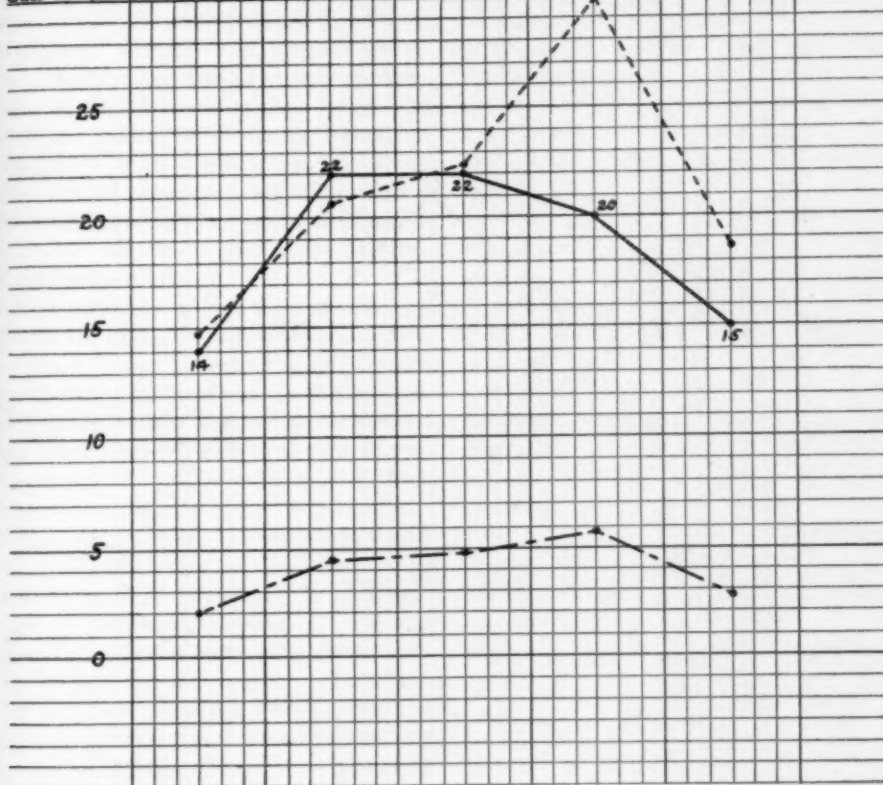
it. But he has. He has paid for it, because the suffering of the worker has lessened his capacity of output. Where this suffering is lessened or eliminated, the output is increased. The workingman who finds pleasure in his work will produce more than he who finds pain in it. It is, therefore, very necessary that the employer shall condition his employes according to humanitarian ideals; and there is no higher humanitarian ideal in industry than the co-operation of the employer and employed in a holy alliance for the prevention of accidents and loss of human life. When the workingman feels that his soul is as precious to the industry as is his body, he will be a better workingman and a more loyal citizen of his country. That may save the employer far more than he realizes—it may save his whole investment, and even save his soul also.

Compensation for an accident is a right. Prevention of an accident is a duty. When the duty is fulfilled, the right will take care of itself.

Does accident prevention pay? Nothing else pays so well.

LOST-TIME ACCIDENTS PER 1000 EMPLOYEES AT ALL PLANTS OF THE AMERICAN CAR
AND FOUNDRY CO.

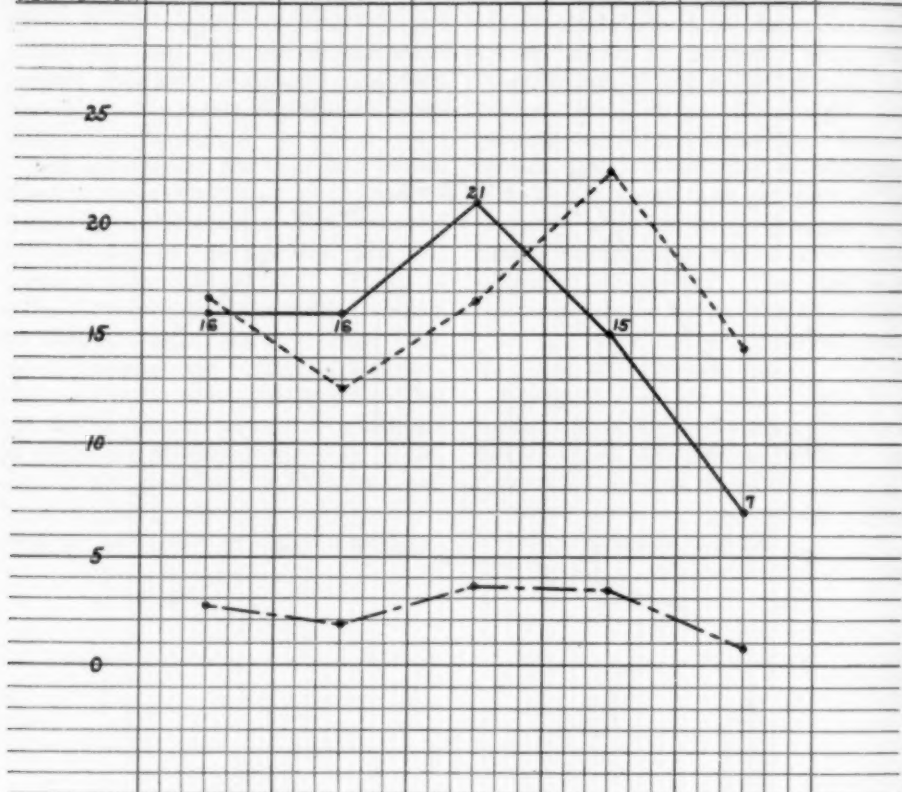
YEAR	1915	1916	1917	1918	1919	REMARKS
AVERAGE NUMBER EMPLOYEES	149,701	207,851	223,677	300,060	186,318	
LOST TIME CASES PER YEAR	2028	4564	4941	5979	2885	



- = NUMBER OF LOST TIME ACCIDENTS PER 1000.
 - - - - = NUMBER OF EMPLOYEES IN TEN THOUSANDS.
 - . - . = NUMBER OF ACCIDENTS IN THOUSANDS.

LOST-TIME ACCIDENTS PER 1000 EMPLOYEES AT ALL PLANTS OF THE AMERICAN CAR AND FOUNDRY CO.

YEAR	1920	1921	1922	1923	1924	REMARKS
AVERAGE NUMBER EMPLOYEES	166,542	127,324	165,044	223,698	143,276	
LOST TIME CASES PER YEAR	2667	1995	3526	3387	982	



———— = NUMBER OF LOST TIME ACCIDENTS PER 1000

----- = NUMBER OF EMPLOYEES IN TEN THOUSANDS

- . - . - . = NUMBER OF ACCIDENTS IN THOUSANDS

Organizing for Safety Nationally

By W. H. CAMERON

Managing Director, National Safety Council, Chicago, Ill.

THE prevention of industrial accidents has become an integral part of the business and industrial life of America. A keener sense of responsibility for human welfare has been awakened among the employers in our country and the practical application of this sentiment has helped to promote more harmonious industrial relations. The increased goodwill on the part of employes, together with a substantial reduction in the deplorable waste of accidents, has made possible a greater production.

Beginning as a *idea* that something might be done to reduce the accident frequency, and prevent the killing and mutilating of workers in hazardous industries, safety has become a practical ideal clothed with concrete forms. The idea of safety was not at first understood, but it has now taken hold of the imagination, the conscience and the will of many of our industrial leaders and is becoming an integral part of industrial processes. Results already achieved encourage those having faith in the movement. The transforming and changing influence of the idea and methods of industrial safety is one of the significant developments of the industrial life of our country. Safety is sane and practicable, beneficial to the employers and to the workers; it is a national asset of inestimable value. The first outstanding fact, therefore, to which I call your attention is that accident prevention is becoming rooted in the progressive industries of our country and is destined to become a transforming influence upon the whole industrial life of America.

Let us try to evaluate the present status of industrial safety by looking briefly at the background of the movement. Men have always been concerned for safety, but in the development of our modern factory system safety rules and methods were nearly always of the rule-of-thumb kind. Previous to 1907 our laws gave to the employer the defenses of "contributory negligence," "assumption of risk" and "fellow servant," which shifted upon the worker the responsibility for his own safety and absolved the employer from blame for the majority of accidents. The modern safety movement started from this background of general belief that accidents were inevitable and that the major responsibilities for their occurrence rested upon the injured individual. With the rapid development of our industries, particularly manufacturing, mining and transportation, there naturally came to the conscience of a number of employers the conviction that it was possible to create wealth and to enlarge our industries and at the same time avoid terrible sacrifices of workers in the processes. Among the first of the large employers was the U. S. Steel Corporation. This company decided that accidents were bad business and instead of looking for excuses to determine "whose fault was it," made its attitude "how could this accident have been prevented?"

In this pioneer work of groping for the solution of the accident problem, it gradually dawned upon the employer that it was his duty first to make the work-place as safe as ingenuity and money could make it and then to

educate the worker about the facts of every accident and to enlist his interest in the correction of unsafe practices. It is also interesting to note that about this time the press published stories of accidents, attracting the attention of the independent public which resulted in the enactment of factory laws. The first factory inspector had been appointed fifty-five years previous in the state of Massachusetts, but in those days there were few safety standards to guide him or codes to enforce. Now there are factory laws of varying standards in all the forty-eight states and factory inspection is a part of state governmental service.

PASSING OF COMPENSATION LAWS

But factory laws and inspection were not sufficient to bring home to all employers and to the public the imperative necessity of industrial safety. This could only be done through the agency of safety laws. In 1908, President Taft issued an executive order putting the arsenals, navy yards, river and harbor works, and the Panama Canal under the compensation principles and on behalf of the civil service of the Federal Government for injuries and disabilities incurred while on duty. This beginning was followed by an agitation in the industrial states for workmen's compensation legislation and during the following years many acts were passed. Several of the first state acts were declared unconstitutional, making certain constitutional changes necessary before permanent legislation could become effective. Now forty-four states, Hawaii, the Philippines and Alaska have compensation laws covering all but agriculture and domestic service. Congress passed an act in 1916, bringing all of the civil services of the government under a

compensation law which, in some respects, is the most liberal and comprehensive ever enacted. The workers of the United States, except in four southern states, are now protected by compensation laws and ere long legislation will be enacted in these states.

What has been the significance of compensation legislation for safety? Because industry has had to pay the bills for all accidents, the larger employers began to learn of the frequency and severity of accidents, the number of lives lost in the course of production, the spoiled material, the interruption to the orderly processes of manufacture. They found, by investigation, that the majority of accidents could be prevented. These employers discovered that it was cheaper to prevent accidents than to pay for them. Therefore, the economic motive for safety received its greatest impetus from the workmen's compensation acts.

The casualty insurance companies are also entitled to praise for the work they have done to promote interest in safety and to develop methods of making the work effective. The mutual type of casualty insurance company grew up and the competition for business between these two classes of insurance companies increased the effort of all insurance companies to give safety inspection and other service to their clients.

OBSTACLES TO SAFETY MOVEMENT

Has safety, then, become deeply and permanently rooted in the entire industrial structure? Unfortunately it has not. Some employers have always had more or less regard for the safety and welfare of their employes; others have resented the workmen's compensation laws, which place upon them the responsibility for all accidents. It was natural for them to object to the compensation principle. It was

a departure from all legal precedent; they were alarmed about the cost and were not sure that the laws would be beneficial. There are many employers of this sort who still comply only grudgingly with safety requirements, who blame all accidents on the worker, and carry on no constructive accident prevention program. I feel confident, however, that the majority of employers are now in full accord with compensation and safety legislation and that all employers will in time discover that these laws conserve their own interest as well as those of society as a whole.

This specialization in safety has developed a flood of literature and publicity—it is not difficult now for the conscientious employer to secure the correlated experience on any particular phase of the problem. Why, then, is it still the case in America, as in other countries, that only the minority of industries are consistently and continuously maintaining interest and exercising complete authority in safeguarding the lives and limbs of the workers in their plants? If we are to make real progress we must correctly appraise our difficulties and shortcomings as well as our successes. The principal reason undoubtedly is this: that while, collectively, the accident bill runs into many hundreds of millions of dollars, the cost to the individual industrial company is relatively small—generally less than one per cent of the total cost of doing business. The executive officers of the company are interested in the ninety-nine per cent; the one per cent is left to the ability of the safety man—to his capacity to win and hold the attention of employes and managers.

Another powerful obstacle is the instinctive unwillingness of the human mind to think of unpleasant things—a fact now well recognized by psychol-

ogists. An earthquake, a famine, a pestilence compel universal attention and the most generous financial response; the dropping of a worker here and there, day by day and in remote places, is taken little heed of—there is a moment's grief in the neighborhood—and the rush of life goes on. Similarly, each worker thinks of an accident as something that is likely to happen to the other fellow, but not to himself. These instinctive barriers the safety worker must overcome.

It must also be admitted that there is a lack of leadership in the safety movement. Because the economic stake in many individual industries is small, small men have been given the responsibility. The minds of the major executives are occupied by the major problems of production, distribution, finance. The only remedy is gradually to bring about, in the national and in the individual consciousness, a greater respect for the safety idea and for the safety movement in each industry and each community.

MAKING SAFETY A DESIRABLE COMMODITY

Let us now turn from the historical to the philosophic side of the American safety movement. Safety will never have universal acceptance until its constructive and reasonable aspects become universally known. The words "Safety First" have done serious injury. This slogan is negative and destructive. No permanent advance in civilization is made on a negative principle. The inner meaning of safety is the preservation of life to continue the adventure of life. If life is worth while, if it is worth continuing, then the safe piloting of life's adventure must depend upon facing the risks of life fearlessly, but with a knowledge of their inherent qualities. Some of the

thrill of life is in meeting its dangers. Our workers, our citizens, must first understand what safety is; it must become a desirable and sought-for attribute of living. It must be worked into the habits of consciousness of children as they are taught to talk and live.

This is the conception of safety that has led the far-seeing business executive to adapt its principles as a part of shop-operation economy. He sees that safety is allied with efficiency; that every accident, or near-accident, causes an interruption to the work and, therefore, limits production. In many instances the study of safe operation has revealed methods for increasing the production. Safety, therefore, as a shop policy has an affirmative meaning to the alert manager—he sees safety as a conservator of men and materials. The method of safety is now coming to be looked upon as man's adaptation or protective reaction to new hazards, such as the increasing variety of power-machinery, and instead of permitting the processes of nature, through the instincts of self-preservation, to develop habits to meet the new conditions, the application of the science of safety is a definite attempt to hasten or facilitate the evolutionary process by focusing attention on each new accident hazard as it develops.

HARD-BOILED PRODUCTION

And yet, with all this advance, there were 85,000 persons killed in accidents in our country last year. Twenty-three thousand in the industries; 20,000 on the streets and highways; 42,000 in our homes and in public places other than in the streets. Six thousand, five hundred of those who were killed in automobile accidents were children under fifteen years of age—human beings who have been denied

the adventure of life. Another 7000 of these children have been killed in home accidents. A majority of those killed in industry are young men—fellows on the threshold of service to their country. What of these thousands who have died—not by "Act of God"—not in war—but often by act of their fellowmen and in time of peace by carelessness, indifference, lack of reverence, selfishness and criminal negligence?

Although the United States has been swept widely and effectively by the industrial safety movement, it yet remains the leader in frequency and severity rates. The 1922 rates show 696 deaths per million of population for the United States and 321 per million of population for England and Wales. Our rates are more than twice in proportion to population of those of any other country in the world. The ordinary hard-boiled production man usually has a pretty hard-boiled superintendent behind him; the superintendent has an equally hard-boiled manager watching him, all three of them with one big thing in their minds—to get production out of the shipping door so that they can get money in the treasury door.

This highly concentrated production effort is what is costing American industries more than a billion dollars a year through accidents, ninety per cent of which are avoidable.

WHAT OF THE FUTURE?

And, now, what of the future? There are two divisions of the safety problem—industrial and public. Let us look first at the problem for the future in industrial safety.

Every fair-minded person, reviewing the accomplishments of the past decade, must admit that we have accomplished wonders. The fundamental principles have been studied;

they are being understood and interpreted gradually; accident prevention is becoming a real force in the industrial life of our nation. And still, when we think of the task ahead of us, a fair-minded critic will tell us that much of the safety activity has been superficial. Accident prevention has not yet been accepted as a problem of the first class in industry. It has been handed over to the subordinates in the business. The stockholders, the directors, the leading officials have not accepted in their consciousness the fact that human safety and efficiency are a major element in the production problem. Manufacturing, salesmanship, finance are the predominating worries of the president and his board of directors. All of the elements that go to make up the human problem in industry have received less consideration than the purely business problems. Safety must be put into the first rank of the business problem of industry. The president of a large corporation said to his safety man: "You know I am very busy and have little time to give to safety, but keep me in touch with your work. It is a non-controversial subject. I can make train conversation of it."

Our problem then is to know how to get this recognition from the men that dominate and control the destinies of business life. A conference dealing with safety is one method. Another is to continuously analyze and show up the benefits securable from the efforts made. But we have deeper problems than that. Much machinery is purchased today without safeguards. The machines cannot be adequately safeguarded until all of the interests agree upon and approve the safety codes. Then the purchasing agent must be instructed to buy only machines guarded in accord with these approved standards. There must be more fundamental

investigation as to why one industry or plant will secure remarkable reductions in accidents, even of the so-called non-preventable accidents, and another work-shop continue year after year to have a bad record. We know in a general way that the best operated work-shop secures the best safety record—that no safety man or safety organization can get a minimum number of accidents unless the standards of operating efficiency in that industry are on a high level. Are there any accidents that cannot be prevented? In one large work-shop only two accidents happened last year due to absence of guards. What were the real causes of the others? The immigrant problem, the nomadic laboring element, the comforts and conveniences in the plants, the hours of labor, the handling of labor, have all a relation to the safety problem. Industry must accept accident prevention as a major problem of operating efficiency. It must accept its social obligations to preserve to the utmost the lives and limbs of the workers subject to the control of the plant conditions.

And what of public safety? Again, this problem has not been accepted by the community as a major problem. Because our cities were not laid out in anticipation of the motor age, the solution of the accident problem on our streets is mostly a matter of traffic control. We need engineering revision, uniform traffic rules and regulations, education of various kinds, but above all else we must crystalize sentiment against accidents. The Hoover Conference on street and highway safety has done something to place this problem in the class of primary importance. But until every community of 25,000 population or more definitely accepts the problem as one of as much importance as education, the water sup-

ply and the transportation facilities, safety will not make the progress that the facts and experiences to date justify.

The safety movement has already been accredited with saving the lives of more than 100,000 persons. This is equivalent to a medium-sized city of human beings which might otherwise have been destroyed. But you will admit that there is still a great distance to go before the goal of reasonable safety can be reached. Apathy and even hostility must be met with and overcome by persistent education. But in spite of the slow growth of the

safety movement the future is bright with promise. The quickening interest of employers, of government, and of many other interests, is a most encouraging sign, and with the co-operation of these forces great strides in accident prevention are possible. I firmly believe that the time is not far distant, as we measure human progress, when accident deaths and serious injuries in industry and on our streets will be the exception. Earnest effort in reducing the casualties of peace is an expression of the highest type of patriotism to one's country and of service to humanity as a whole.

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Organizing a Local Safety Council

By JULIEN H. HARVEY

Director, Kansas City Safety Council

THERE was a time—and not so many years ago—when the pioneers in the accident prevention movement were looked upon as a group of enthusiasts industriously engaged in a pursuit of the rainbow. This was succeeded by that question often asked—and by high grade industrial executives at that—as to whether there was real merit in the safety movement. To an extent, we still find this feeling in certain quarters to-day but slowly and surely that resistance is disappearing and business is coming to realize that safety is one of the necessary factors in the well regulated industry.

Many agencies have played a part in bringing about this changed condition and among these has been the National Safety Council with its gradually increasing number of local units, known as Community Safety Councils. In tracing the history of these local groups, we find that in the first instance, their efforts were largely confined to the industrial phase of accident prevention work. There were two very obvious reasons for this trend. First, safety had started as an industrial proposition and it was only natural that concentrated local effort should follow that line. Second, very little was known of the public and home accident situation and its indirect effect on industry.

However, as time passed and with it there came a better understanding of the problem and its widespread ramifications, the local council for the development of accident prevention measures in the plant became a Community Safety Council pledged to the

carrying on of a comprehensive program for the elimination of accidents in the home, on the street, and in the industry.

Consequently when we speak of organizing a Community Safety Council, we must consider the problem of bringing together a group in the community, representative of all phases of community life interested in this problem, both from an economic and humanitarian standpoint.

The value of co-operative effort and an interchange of ideas, to say nothing of the success which has come through the work of Community Councils themselves, is such that I feel it unnecessary to present arguments in favor of definite organization. We have the accident problem before us and in no other way than through study and the application of the results of our studies, can we bring a change in existing conditions.

It is assumed that if any value is to come from the perusal of this article it must be largely from those communities not now engaged in work of this character. Consequently, I would like to briefly outline those steps necessary in the formation and successful carrying on of a Community Safety Council.

FORMATION OF COUNCIL

First, every movement must have its leaders and it will accordingly be up to some one individual or small group of individuals to, in the vernacular of the street, "start the ball rolling." This group, and it makes no difference if their interests are selfish, should first

analyze the local problem and in a general way estimate the task ahead. Following this should come a larger meeting to which should be invited representatives of all interested industrial, civic and official agencies. At this meeting, the community's accident problem would be frankly discussed and the value of organized effort stressed. Assuming that the response is favorable, this meeting will result in the appointment of a strong committee, whose duties should be to prepare definite recommendations on:

- (1) Machinery for handling the affairs of the proposed Council.
- (2) Tentative program of activities.
- (3) Suggested budget.
- (4) Plan of financing.

Conditions vary in communities to such an extent that it is impossible to lay down any fixed plan from which no deviation should be made. However, insofar as possible in organizing and providing the machinery to carry on the work of the Council, the recommendations of the National Safety Council as set forth in *Standard Practices for Community Safety Councils* (Volume 5) should be followed. This provides for a governing board composed of representatives of all lines of business directly interested in this problem as well as certain civic and official agencies. From this group can be selected, in addition to the Council officers, the chairmen and possibly members of such standing committees as the program calls for.

Emphasis should be placed on the value and even necessity of securing the right men for this board. Get the really representative men in the community and be satisfied with nothing less. The standing of this group may

mean success or failure in the Council work.

A WORKING BASIS

Next, if the Council is to be financed through some existing agency, then the recommendations of the committee will be confined to a tentative program and budget based on an assured income. On the other hand, if the income is not assured then the method of financing must be prepared. The most practical plan yet evolved is what is known as the "group plan" (see *Standard Practices, Community Safety Councils*, Volume 5), which is in operation in many cities. Through it, a definite quota is assigned to each of the groups represented on the governing board and on the group representative is placed the obligation of securing this quota. In this way, the members of the board are given a direct interest in the spending of the money which they, in part, have raised.

Assuming that these recommendations of the committee are approved, a set of by-laws adopted and officers elected and installed, the first step should be to eliminate the financial problem, if one exists. By all means should this be done before the program is started. During the first year it may be necessary for the more important interests to assist to a greater extent than in future years. As a matter of fact, before the formation of the Council is even publicly suggested, there should be an assurance that financial assistance will be forthcoming. However, do not make the mistake of going part way and then becoming possessed with the idea that you should stop and engage in some activity in order to sell the public on your aims and purposes. Get your financial problem out of the way and then, if need be, revamp your program to fit your resources.

As to the program and budget, it is

urgently recommended that provision be made for a salaried manager. The success of this plan in over forty cities leaves no question as to its value. Voluntary service is very necessary, but beyond a certain point, we have no right to ask it. In the event that the community is not large enough to support a full time manager, then a part time man should be secured.

As to the program itself, do not attempt too much at the outset. Carefully choose a few definite activities which can be carried on thoroughly and successfully. That you may properly know and analyze your problem, begin at once on a well grounded plan for the accumulation of statistics. This is vital. Do not attempt to go too fast. On the other hand, let your activity be such that when your first year is closed, you can go to your public with a

record of accomplishments which will guarantee your future success.

The board or controlling body should meet frequently and at regular intervals—weekly if possible. Your standing committees should also meet periodically. Carry through to a conclusion every suggestion offered. Work on the theory that the Safety Council is a business organization for the service of the community and its members. In other words, leave no stone unturned to create good will and confidence in the organization. If these come then you will know that your job has been well done.

Do not be discouraged if at times results seem slow in coming. Rome was not built in a day and a problem as old as safety cannot be controlled overnight. It is all a matter of keeping everlastingly at it.

The Part of the Casualty Insurance Company in Accident Prevention

By DAVID VAN SCHAACK

Director, Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company, Hartford, Conn.

AS a factor in industrial accident prevention the casualty insurance company is certainly not surpassed by any other agency, and in the effectiveness of its work over the widest range it is unequalled. Its importance in this field is due to the fact that accident prevention is a necessary part of its business so far as workmen's compensation and employers' liability insurance are concerned. Just as the accident prevention work of a plant is most effective only when it is considered an essential part of the plant's successful operation, so the casualty insurance company is in the best position of all agencies to promote accident prevention throughout the country. It comes into contact with more industrial plants than are reached by any other accident prevention agency, and the proper conduct of its business makes this contact most effective.

Insurance is not a commodity in the ordinary sense of that word, yet its sale is affected by price just as the sale of commodities is affected. In either instance, if the price is too high, the sales will not be so great. The casualty company, therefore, has to avail itself of every possible means of keeping the price of its insurance down to the point which will assure it the readiest and largest market. The managers of casualty companies, like all other good citizens, are deeply concerned, of course, in the conservation of human life and limb, and they would undoubtedly interest themselves in accident

prevention work even if it were not a necessary part of their business. The fact that it is, however, has certainly led them to go much further than they would otherwise have done in pushing their accident prevention work.

While a great deal might justly be said of the accident prevention activities of individual casualty companies, it is their joint work in the establishment and development of merit rating that has chiefly made possible the large part which the casualty company plays in accident prevention. It is beyond question that merit rating, including both schedule rating and experience rating, is the most important contribution to the cause of accident prevention which has been made by the casualty companies or any other agency. The application of merit rating directly touches the pocketbook of the employer and, therefore, presents accident prevention to him in the light in which it is best calculated to make a strong appeal. Many employers, of course, are interested in accident prevention from the humanitarian standpoint but, like insurance companies, even they would not go so far for this reason alone as they will go when it is impressed upon them how accident prevention affects their monetary interests and, therefore, enters properly into the regular conduct of their business. And, of course, there are employers who need this direct financial stimulus to lead them into the accident prevention field.

Under the merit rating system, the

insurance rate for a plant is possible of development in three steps: The first, of course, and the only one until the establishment of merit rating, is the classification of risks into groups so as to differentiate one industry from another and assign it a basic rate proportionate to its own degree of hazard. The manual rate, so called, which is thus developed, is based upon the experience of the industry as a whole and gives no recognition to those plants in an industry which for one reason or another are able to have a loss experience more favorable than that developed by the industry as a whole. It was to meet this inequity between different plants in the same industry that the merit rating system was devised. This system consists of two parts, schedule rating and experience rating. Schedule rating undertakes to vary the manual rate of a plant according to the greater or less probability of its having the average experience of plants in its industry. It has been well termed "a plan for the re-classification of risks within the manual classification." It accomplishes this re-classification by noting through careful inspection the physical and mechanical conditions of the individual plant, and developing credits or debits as these are found to be in good condition or otherwise. In this way the physical hazards of a plant are measured.

SCHEDULE RATING

Schedule rating has been refined gradually but steadily ever since it was first established, until it now measures with a very fair degree of accuracy the physical hazards found in a plant. This refinement has been done by classifying and listing causes of injury and noting the losses resulting from it. In this way the respective weights which should be attached to the several

causes have been determined from actual experience. Let us take furniture manufacturing plants as an example. In these, it was found, upon research into the country-wide experience of the members of the National Bureau of Casualty and Surety Underwriters, that 66 per cent of the losses are due to five principal causes, namely:

	<i>Per Cent</i>
Elevators	1.5
Power transmission	1.5
Machine driven devices	1
Machine moving parts	7
Machine point of operation	55

The experience from which these percentages are derived covers such a wide range that they may be considered fairly dependable, and the schedule, therefore, gives each of the causes making up this experience its proper weight. Eliminating this 66 per cent, there is still 34 per cent of accident loss cost to be attributed to other causes of accidents. It is not possible to trace this 34 per cent so conclusively to its separate causes as can be done in the case of the causes already mentioned, so the schedule undertakes to cover these, which include physical, mental and even "moral" causes, by what is known as safety organization. Under this section the schedule gives a credit for certain definite features of safety organization, including supervision, inspection and safety education, as well as medical treatment, all of these having an effect upon the whole hazard of the plant as well as an influence upon the miscellaneous causes to which it is difficult to attribute accidents so directly. The application of the schedule to the conditions of the individual plant, therefore, varies the manual rate according to whether these conditions are good or otherwise, and to what steps the management of the plant has taken to safeguard its

employees against accident, to educate them into safe habits of working, and to take care of such accidents as may develop despite all the precautions taken.

Schedule rating was a long step toward the proper adjustment of rate to an individual plant within a given industry, but it is not applicable to risks of all kinds for, as will be readily inferred, its principal application must necessarily be to risks which have a considerable mechanical hazard; nor is it applicable even to those in the case of plants of all size. The annual premium of a risk can be too small to justify the expense of inspection and rating under the schedule rating plan, and such risks, therefore, are rated simply on the manual basis. When a premium is large enough, and there is sufficient estimated annual payroll to justify the necessary inspection and survey work, schedule rating is applicable. Such risks get at least one rating inspection each two years with an interim survey each year, and the ones of larger premium are inspected annually and get from one to two interim surveys each year.

These inspections are made in one of two ways—either through a central inspection bureau supported by the companies or by the companies individually; in the latter case the company inspections are filed with a central bureau for checking and promulgation, and usually this authorized bureau is called upon to inspect new risks for all companies as well as to check renewals by inspecting risks selected at random, thus getting an idea of how closely the inspector of the company itself has followed the schedule. Under either system there is still much left for the individual company to do. If it is keenly interested in the retention of its business it will not be satisfied with letting the bureau inspector sim-

ply record conditions as they are for the purpose of determining the correct rate, but it will inspect the risk itself with a view to pointing out to its assured how, by the making of certain improvements, his rate will be favorably affected. The individual company is, therefore, bringing constant pressure to bear upon its assured to make possible further reduction of his rate under schedule rating by having all the physical and mechanical conditions of his plant brought fully up to standard.

EXPERIENCE RATING

Experience rating, so far as manufacturing risks are concerned, is used further to modify the manual rate, or the manual rate as adjusted by schedule rating, to make it fit the individual plant. Schedule rating cannot be completely effective in this respect even as regards manufacturing risks, for it deals principally with physical hazards, and its operation cannot demonstrate whether the granting of a credit for the so-called "morale" items—such as complete safety organization and proper provision for medical service—is really justifiable. Nor can its operation fully justify the credits which it may give for the installation of physical safeguards which, in order to be really effective, must be both kept in good order and used by the workmen. Experience rating, being based upon the actual loss experience of the plant, shows to what extent the provisions for which credit is given by the schedule rating plan really do affect the plant, and then proceeds to adjust the premium in accordance.

In the case of other than manufacturing risks, experience rating furnishes the only possible means of applying the general principle of merit rating. It determines the variation of the individual risk's experience from the average experience of risks in its man-

ual classification, and thus makes it possible to modify, for the individual risk, the manual rate.

As in the case of schedule rating, it is not practicable to apply experience rating to all risks. In the case of some, the experience is too limited. Where the experience of the individual risk is comprehensive, however, the result it shows may be depended upon with fair accuracy, and will, therefore, justify a variation, often considerable, from the manual rate. The formula for experience rating involves some factors which are too complicated to be discussed briefly, but it may be summarized in the statement that it takes into consideration both the payroll exposure of the individual risk and its hazard as shown by actual loss experience.

MERIT RATING

The entire system of merit rating, which was first devised by the casualty companies and ever since then has been constantly refined with a view to making it more accurate, is undoubtedly the greatest single influence in the promotion of accident prevention in industry. Schedule rating offers the individual plant, having or developing good physical conditions and undertaking "morale" work, the incentive of a rate variation based upon the probability of such a plant having a better loss experience than the average of its industry, upon which, of course, the manual rate must necessarily be based. The estimate of this probability is founded upon actual loss experience in the industry showing that certain physical conditions do tend to reduce accidents from definite causes, and also upon the fact that "morale" work, if properly carried on, will have its effect too upon accident occurrence and severity. Experience rating, in the case of the manufacturing plant, is able to modify the rate more pre-

cisely and more justly because it is based upon the actual loss experience of the plant, and is thus enabled to go beyond the probability of accident prevention into the definite field of real accomplishment. As far as other than manufacturing plants or operations are concerned, experience rating offers the only means at all dependable of modifying the manual rate on any scientific and therefore justifiable basis.

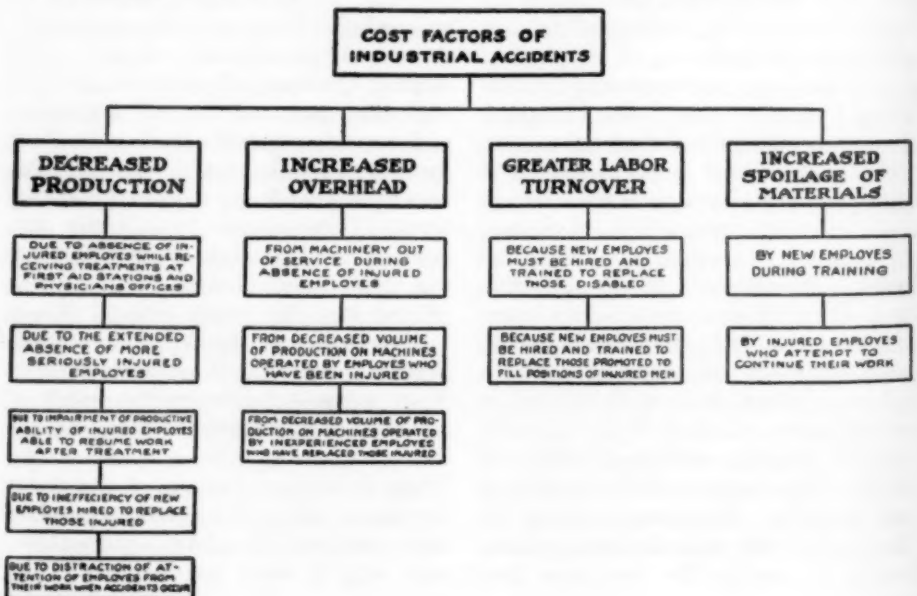
THE INDIVIDUAL CASUALTY COMPANY

While emphasis has naturally and properly been placed upon this system of merit rating as the most notable contribution of the casualty insurance companies combined to the furtherance of industrial accident prevention, the work of the individual casualty company in this direction cannot be ignored, as it is of the greatest importance. It is, of course, possible for the individual company to depend, wherever rating inspections are made by a central bureau, entirely upon the inspections of that bureau, and not interest itself further in accident prevention or the welfare of its clients. The casualty company which desires to be successful in the workmen's compensation and employers' liability field cannot, however, afford to be satisfied with this, and it is not. It maintains a force of engineers and inspectors located throughout the country who continually seek to stimulate the interest of its assured in accident prevention work, and to help him take full advantage of the opportunities offered him by merit rating. These engineers check carefully the classifications of work in the assured's plant. They point out how improvement of physical conditions will tend to secure modification of the assured's rate. They show him how to make these improvements. They point out effective methods of safety organization, and help in their installation. They

review the accidents of the plant and offer practical suggestions for remedying the conditions causing these accidents. They keep in regular touch with the progress of the plant's accident prevention work, whether in safeguarding or in the functioning of its safety organization. The engineering and inspection department of an up-to-date casualty insurance company also conducts researches with a view to finding ways of eliminating causes of accidents. In fact, the casualty insurance company is continually at the service of its assured in the interest of accident prevention; and this service means much more than merely a modification of insurance rates. Both the casualty company and the thinking employer know that modification of rate is only a part of the benefit accruing to an employer from control of accidents in his plant—in many instances only a relatively small part. Accidents in a plant not only affect its insurance rate but have an unmistakable and a large bearing upon the plant's efficiency.

As this paper must be confined, in

accordance with its title, to the part of the casualty insurance company in industrial accident prevention, it would be out of place to refer here to its work in many other fields than the industrial one. The same principle—that of eliminating the causes of loss—which the casualty company applies in connection with its workmen's compensation and employers' liability insurance is applied also by the progressive casualty company to-day to every other insurance field in which its application is at all possible, and in such degree as possibility permits. The casualty company recognizes to-day that it cannot be satisfied simply with insuring against an existing hazard at a rate proportionate to the hazard, but that if it is to be successful as a business institution, and if it is to do its full part as one of the most necessary factors in modern social development, it must seek in every possible way to diminish the hazards against which it offers insurance protection. This practice is not only good business but good morals, and the progressive casualty company recognizes it to be both.



The Need for More Definite Analysis of Accident Causes

By LUCIAN W. CHANEY
U. S. Bureau of Labor Statistics

NO admonition is more necessary in statistical discussion than "define your terms." It is altogether too common for discussion to become heated and even acrimonious when the only difference is one of definition. No wars have been fiercer and more long continued than those about words.

Accordingly the first step now may well be a consideration of the significant words of the above title. What is meant by a cause? What by accident? What by analysis?

It is easily evident that there are two groups of factors in the causes which enter into the occurrence of an industrial accident. The physical conditions by which the worker is surrounded are easily recognized as possible sources of an accidental injury. These physical causes are for the most part functions of motion. The motor vehicle moving from place to place is dangerous because of this motion and is increasingly dangerous in proportion to the swiftness of this motion. A machine presents elements of hazard because some of its parts are in motion.

The other group of factors in industrial injury is the condition of the worker himself, his age, his degree of experience, the state of his digestion. All these subjective matters may play a part in the occurrence of an injury.

Very much the larger share of attention has been given in the past to the physical causes of accident. Indeed the classification of causes¹ prepared by the Committee on Statistics of the International Association of Industrial Accident Boards and Commissions does

not attempt to cover anything but the physical causes.

The reason for this exclusive attention to one phase of the subject is not far to seek. These physical causes are easily observable and may be defined with some degree of precision. The subjective causes are obscure, difficult to observe and still more difficult to measure. Therefore for the purposes of this paper attention will be directed to the physical causes of accident.

What do we mean by an accident? We can scarcely do better than accept the limitations suggested by the International Association. While it cannot claim universal use it is the most largely used definition and ought to be regarded as standard. For use in statistical studies the Association suggests this definition of a "tabulatable accident"; namely, "An accident causing death, permanent disability or temporary disability beyond the day or shift in which the accident occurs." The insurance companies used to use, "Any bodily damage however trivial," and for their purposes this was not a bad definition. Its main defect, experience has demonstrated, is that it is not possible, without a greater attention than its value justifies, to secure complete reporting of the trivial accidents. When disability even of a day results a record is sure to be made of the case. The standard definition will be understood in this paper.

A SIMPLIFIED CLASSIFICATION

What is analysis? Broadly speaking it is the separation of a group of items into parts which can be more easily understood. It may be well at this

¹ Bulletin 276, U. S. Bureau of Labor Statistics, p. 36.

point to record the fact that this paper will not support the contention to which it seems committed by its title. The classification² proposed by the International Association is certainly as elaborate and definite as can possibly be justified unless the volume of basic data is exceedingly large. There are two things which a statistical table may do. (1) It may record facts. (2) It may indicate the trend of events and establish relations. Whether it meets the first of these is dependent on the quality of the original data and the care and skill with which they are handled. To be a reliable index of the direction and kind of motion characteristic of the group of events the data must not be overanalyzed. It is exceedingly easy, in the desire to display all possible phases of the subject under consideration, to push the analysis to a point where the items of the record lose their coherence and fall apart into discrete units which have little or no statistical significance.

The classification proposed by the Committee on Statistics has 11 primary divisions. These are subdivided in the complete classification into a total of 758 items.

In simplifying this classification for use in the iron and steel industry the primary groups were reduced to 9. These primary groups were then subdivided as follows: Machinery 199, Boilers and Steam Pressure Apparatus 9, Vehicles 46, Hot Substances and Electricity 31, Falls of Person 23, Falling Objects 22, Objects and Tools being handled 25, Miscellaneous Causes 14. A total of 369 items. The classification is so adjusted that the items in each primary group can easily be increased to 99, making a possible total of 999 items.

It is evident that since the machine

² Bulletin 276, U. S. Bureau of Labor Statistics, p. 36.

division was developed to cover conditions in the iron and steel industry, it would have to be expanded to meet the case of other industries.

Experience in the application of this simplified classification soon demonstrated that when used for departments of the industry even for periods as long as five years, it often happened that the available data were not of sufficient volume to give dependable results. In fact the industrial statistician is quite on the horns of a dilemma in avoiding overanalysis on the one hand and failure on the other to separate things which must be separated in order to be understood.

It may be suspected that advocates of "more definite analysis" have in mind not an extension of the classification of physical causes, but an excursion into the field of subjective causes. Indeed one such classification has been proposed and an attempt made to use it. It can only be said of such efforts that they should be tried with the utmost caution. Under present conditions it is entirely impossible to secure reliable data regarding the inner state of the worker's personality, nor does it seem reasonable to expect in the near future a situation in which such data of a dependable nature can be secured.

If, then, a satisfactory "more definite analysis" is to be secured neither by extending the classification of physical causes nor by trying to "psycho-analyze" the worker, is there no field which may be studied for further enlightenment regarding accident causes and how to meet them with an adequate accident prevention program?

The answer to this query may be unqualified. There certainly is.

CAUSE AND EXPOSURE FACTORS

It is gradually coming to be understood that sorting out accidents into their appropriate cause groups and

entering them in their proper squares on a tabulation sheet should not even be dignified as a statistical proceeding.

Suppose for illustration an entirely impossible situation; namely, two industrial concerns engaged in the same line of production whose accidents when sorted, as suggested above, fall into identical spaces on the tabulation sheet and have the same number in each space. So far as this treatment goes the two concerns are in the matter of accident causes identical. Suppose now it be noted that one concern is twice the size of the other. At once the conclusion suggested by their identical record is seen to be erroneous. The concern having twice the amount of exposure has half the hazard of the other.

An analysis of causes however "definite" which ignores the element of exposure is a mere record of facts with no value as indicating trend or relation. This applies to industrial establishments, to industries, to states, to occupations. An absolutely necessary factor in the real understanding of the problem is this factor of exposure.

Unfortunately the great body of statistical effort regarding causes has been expended in sorting and recording. The futility of this proceeding is amply indicated by the multitude of illustrations like the above which could easily be produced.

Before attempting an exposition of the use of exposure as a base for calculating dependable and informing cause rates, it is desirable to call attention to another field of investigation which may profitably be considered in the study of accident causes.

In the illustration used above the cause record was supposed to be identical for two concerns while exposure was twice as great in one as in the other.

Consider a case where both cause

record and exposure are identical in the two concerns. Is it justifiable in that case to conclude that accident hazard is the same in each?

The answer will require that we examine the various causes listed with reference to the severity of the accidents. Suppose this examination results in the discovery that one concern has more deaths than the other, a larger proportion of permanent disabilities and that its temporary disabilities are of average greater duration. It is at once evident that while from the standpoint of number of cases the concerns were identical, in the matter of severity there was a difference which ought to have a means of statistical expression.³

The method of computing frequency and severity rates is now sufficiently well known to make it unnecessary to present it here in detail. It is sufficient to say that a scheme of time allowances was worked out in the Bureau of Labor Statistics and later was modified by the committee on statistics. This gives an allowance of 6000 days for death with allowances proportional to this for loss of hand, eye, foot, etc.

At the same time that this scheme of time allowance was worked out the committee recommended that exposure be recorded in terms of hours, permitting the base for accident rates (both frequency and severity) to be expressed in multiples of 1000 man-hours, giving the same opportunity in accident statistics that has prevailed for a long time in vital statistics.

To bring out the value of rates in the study of accident causes this statement follows closely that already published by the Bureau of Labor Statistics.⁴ It presents an analysis of cause quite "definite" enough for all practical

³ See Bulletin 298, U. S. Bureau of Labor Statistics, p. 17 et seq.

⁴ *Ibid.*, p. 25.

needs with a synthesis of the causes with the exposure essential to any sort of understanding.

For any plant, department, occupation or other industrial group, for which exposure and number of cases and economic loss as determined by the application of the schedule of losses approved by the International Association are known, frequency and severity rates can be computed. If now the causes have been classified the proper proportion of the rate can be allocated to each cause. To illustrate this point one of the simpler groups of causes, namely, Falling Bodies, is chosen.⁵ The exposure is used in terms of 10,000 hours to avoid small decimals. Severity rates are commonly computed on a base of 1000 hours.

Regarding Table A, it may be observed first that in hazard of loss of time, "Open Hearths" are at the top

of the list with 8.06 days per 10,000 hours exposure due to falling bodies. This divides to the various specific causes 3.27 to objects tipping over, 1.05 to objects falling from piles and 3.64 to miscellaneous causes, no one of which is important enough to be separately shown. A few scattered items make the balance.

The use of frequency rates in the measurement of accident causes may be illustrated by a particular case. In a group of blast furnaces it was found that the frequency rate was 67 per 1,000,000 hours exposure. Of these 67 cases, 19 were due to molten metal, 9 to handling tools and objects and 39 to unclassified causes. In this case the department was taken as the unit. If a smaller unit such as an occupation be used as a basis the rates would be based on the amount of exposure in the individual occupation. In the case of the above group of blast furnaces it was

TABLE A.—SEVERITY RATES (DAYS LOST) IN DEPARTMENTS OF IRON AND STEEL 1914 TO 1919 FOR FALLING OBJECTS PER 10,000 HOURS EXPOSURE.

ACCIDENT CAUSE	BLAST FURNACES	OPEN HEARTHES	FOUNDRIES	HEAVY ROLLING MILLS	FABRI- CATING	MECHAN- ICAL
Collapse of scaffold or staging.	....	.02	....	....	....	.01
Object falling from:						
Buildings.....	.06	....	.01	....	....	.82
Chutes, conveyors or slides	.01	.01	....	....	....	.01
Machines or work benches	....	.01	.03	.04	.05	.87
Piles.....	.14	1.05	.07	.17	.07	.05
Racks and shelves.....	.01	....	.01	.01	.01	.01
Runways and balconies...	....	....	....	....	....	....
Scaffold and staging.....	.02	.01	....	....	.01	.02
Temporary floors.....	....	....	....	....	....	....
Tramways and trestles...	....	....	....	....	....	....
Other elevations.....	5.02	3.64	.53	.57	2.29	.47
Cave in of ditches.....	....	....	1.96	....	....	....
Objects tipping over (not ve- hicles).....	.12	3.27	3.11	.54	.66	.25
Other falling objects.....	.12	....	.03	.32	.01	.01
Total.....	5.50	8.01	5.77	1.65	3.10	2.52

⁵ Complete Table. *Bulletin 298 U. S. Bureau of Labor Statistics*, p. 43.

possible to isolate some of the important occupations and compute accident rates for the causes found operative in each occupation. While the frequency rate for the blast furnaces as a whole was 67 per 1,000,000, that for the cast house men was 127. Analysis of this rate showed that molten metal had among these cast house men a rate of 67, falling objects 14 and other causes 46.

These cause rates whether computed for the department, the occupation, or any other group are true accident rates analogous to the death rates as used in mortality statistics. In such studies it is customary to divide the general death rate for a community into specific rates for the various diseases causing death. Thus a general death rate for a given city of 20 per 1000 population might be made up of specific rates as follows: tuberculosis 5, typhoid fever 2, other causes 13. These rates are a real index to the prevalence of death in the given community. It is sometimes thought that a comparison of the percentage of death due to various causes affords some enlightenment. Such comparison is almost sure to be misleading. Thus in the year noted deaths from tuberculosis constituted 25 per cent of all deaths (5 out of 20). Suppose that in the following year a typhoid epidemic increased the typhoid rate from 2 to 7 and thus increased the general rate from 20 to 25. The tuberculosis rate would remain unchanged but expressed in percentages tuberculosis would have decreased from 25 per cent (5 out of 20) to 20 per cent (5 out of 25) as a cause of death. The

percentage change would suggest a marked decline in the importance of tuberculosis when, as the rate accurately indicates, it remained absolutely stationary. The same sort of error is possible and common in the consideration of accident causes.

It should be noted that the rate method is applicable to many other phases of the accident problem. Take for example the nature of the injury: In certain blast furnaces having a frequency rate of 63 per 1,000,000 hours exposure, further analysis by the rate method disclosed a frequency rate of 30 for bruises and lacerations, 15 for burns, 3 for fractures, and 15 for other injuries.

The contention then of this paper is that for improvement in handling of accident causes there are two hopeful directions in which attention may be directed: (1) Backward to a better, more careful, more exact original reporting of the cases. The causes of accident are almost infinitely complex and their adequate recording demands a degree of care and competency which is not always given. (2) Forward not to a more elaborate analysis of the causes themselves but to the proper determination of the exposure and its application to the cause classifications now commonly made.

Such a procedure will give intelligible and universally comparable indices of the importance of accident causes. It will show accurately the changes which are occurring. It will redeem the study of causes from a certain futility which pertains to sorting and recording.

Safety Education in the Public Schools

By ALBERT W. WHITNEY

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WHEN safety is made a matter of serious study two fundamental relationships come into view that are in themselves sufficient to orient the movement. These are first, that safety is only one of the manifestations of a deep thoroughgoing efficiency that will show itself not merely in production but in safety and morale as well and, second, that safety is primarily a matter of the head rather than the hand and hence pre-eminently educational.

The development of the implications in each of these relationships will have the same general effect of moving safety out of the foreground and of putting it in its natural place in the picture. It will appear on the one hand as a particularly vivid and human aspect of the problem of organizing industry along fundamentally efficient lines, and it will appear on the other hand as a particularly vivid and human aspect of the problem of getting an education in the true sense, namely, an attitude toward life. It is already evident that the safety movement, after going through the preliminary maneuvers of finding itself, is settling down to having its main development along these lines.

The educational problem in the safety field is almost as broad as the movement itself, for it is evident that to reach executives and to work through shop committees and bulletin boards and through other kinds of publicity may all be considered as primarily educational.

However, there is back of this the more strictly educational activities of the public schools, where something far more fundamental is being attempted,

namely, to give children an attitude toward life that will make them choose to be safe.

A child comes into life with some instinctive and emotional predisposition toward safety, but for the most part his attitude of mind and his specific reactions must be acquired. The home has been the natural place in which these habits and attitudes have been acquired, but with the growing complexity of life the home has lost its hold and the problem will largely have to go over to the school, as has been the case with other subjects.

The need for such teaching is very great. There are not only 20,000 accidental deaths per year to children of school age in the United States, but the complexity of modern civilization is increasing so rapidly, and particularly in the traffic field, that a new generation is needed that will handle the problem more wisely and effectively. Safety teaching will accomplish specific results in both saving life and in producing a new generation with a better outlook. Actual experience has shown on the one hand that the death rate can be cut at least fifty per cent through safety education and children are being affected so profoundly by it that the influence may be counted on to extend into adult life.

The real problem in getting safety education into the schools has not been in demonstrating its effectiveness in reducing accidents and in producing a safer generation, but it has been in showing that safety had a rightful claim to a place in a curriculum that was already over-loaded. With no

safety teaching the death rate per year from accidents among children of school age or under is about two for every 4000 children. We may be able to save one of these, perhaps one and a half, but what about the other 3998? We are not saving their lives because their lives are not going to be lost. What effect then are we producing upon them? Have we a right to subject 4000 children to instruction that will be necessary for only two of them and that will be effective for only one? There may be other subjects that will be far more profitable from the standpoint of the 3998. The school problem then is very largely one of determining whether the subject of safety has educational value; in other words, what will be the effect upon the 3998 rather than upon the two who will come face to face with death?

To-day it looks very much as though safety education would definitely take its place in the school curriculum. Enough schools have tried it to show that it is practical in its effect upon public safety and that it actually has educational value and the response on the part of the children has been quite overwhelming. Furthermore, the educators themselves have become interested in it and are giving the movement their support. It seems safe now to predict that in a reasonably short time safety will be part of the curriculum in every progressive school.

EDUCATIONAL VALUE

I propose to present briefly the claim of safety education to a place in the curriculum on the ground of its educational value. The problem is this: What does it do to a child to teach safety to him? Where does safety belong in the picture if we look at education in its twofold aspect: first, of making one able to make his life more effective and, second, of getting more satisfaction out

of it? In the brief statement that follows I shall not attempt to present either supporting reasoning or evidence.

In the first place we must realize that the school problem is very different from the industrial problem. An example is the use of the term "Safety First." While the use of this as a slogan for any purpose leaves much to be desired, it has nevertheless served fairly well in the industrial field and particularly in the railroad field where it apparently originated, for safety under ordinary circumstances may properly be made the first consideration in both of these fields. It is curious, however, how completely inappropriate this slogan is in the educational field. If it is taken literally it means that we are to teach children that safety is the very first consideration in life, to be valued more than honor, or truth, or love, or bravery, or courtesy, or liberty. This of course is flagrantly false. It has been the high-souled men and women who were not afraid of taking a chance, if it was the right kind of a chance, that have succeeded and they are the ones that we most admire. Adventure has been and always will be the one particular quality that gives a flavor to life and true adventure necessarily involves danger. The kind of safety that we should be willing to have taught to our children in the schools is evidently a very different thing from the safety of "Safety First," if this is to be taken literally.

This is given merely as an example of how necessary it is to re-examine the whole subject if it is to be used for educational purposes. If safety is to be considered as an attitude toward life rather than merely as a technique, it must be analyzed and we must know what this attitude really is.

Safety in reality instead of being inhibitory and thus reducing the adventure in life is substitutional. It

cuts out the poor adventure to be sure, but only in order to make place for a better adventure. A better slogan than "Safety First" for school use would be "Safety for More and Better Adventures." This subject gets its educational significance largely from the fact that it brings a child face to face with the problem of making judgments of relative values. The child must be able to decide what adventures and experiences are worth while and what are not worth while. To do this he has got to get clear ideas about life, and what it is for. An accident is something that implies order or purpose, for otherwise everything would be equally casual and an accident could not be recognized as such. A study of safety from this point of view is therefore a study of conceptions that are at the very heart of civilized life.

Safety not only takes us into a field that is rich in its educational significance but one that is equally rich in emotional content. Much of the school curriculum, for instance spelling, has to be motivated by an appeal to such forces as the desire to excel. Such subjects in themselves have very slight emotional value. Safety, however, has been a life and death matter since the beginning of life itself. The consequence is that it has become as a matter of inheritance an instinct, so that in teaching safety we find that we are dealing with a field in which children are thoroughly sensitized. The practical effect is that we are not teaching against resistance but rather continuing along lines that have been ploughed deep by the rude forces of life itself. The keen interest of the children extends not merely to the ideas themselves but into getting practical effects. Their eagerness is most noticeable and significant.

Another advantage of safety education is that the subject can be graded,

starting with the simplest examples of purely personal safety, such as the avoidance of burns and falls, and going over to the most complicated situations that lead even into the field of moral safety. Furthermore, the field can be developed from the purely personal side on the one hand, all the way over to a consideration of the most complicated social problems, such as traffic, sewage, water supply, and sanitation. The subject, therefore, may be used in all the grades from the first grade right through into the high school.

The underlying principles of safety may scarcely come to the surface in teaching, at least in an explicit form. The teaching itself is mostly concerned with the actual technique of safety. The technique of teaching safety is something that is now in the making. It is naturally a matter of slow growth. The problem in general is one of converting a subject which at first sight is negative, inhibitory and unattractive into a subject that has positive character and real charm.

TEACHING SAFETY

It is quite certain that safety should not be taught by itself as a separate subject. There are two ways of teaching it, both of which are not only good but the best results can undoubtedly be secured when one method supplements the other. Safety may be taught as a part of the general problem of adaptation to life. Modern education is largely technique, for, with the growing complexity of the world, more and more technique is needed. But in addition to technique we greatly need a better and fuller adaptation to life. In periods of the world when there was little progress the problem of adaptation to life was comparatively simple. The process consisted for the most part in learning the *mores* of the tribe but to-day our *mores* are changing so rapidly

that something more fundamental is needed; even a child must have some fundamental principles, must have at least the beginnings of wisdom, that will form the basis for decisions in a world that is constantly changing. The difficult problems that confront the world to-day are those that have to do with war and peace, with international relations, with industrial relations, with social relations such as marriage and divorce, tolerance, religion and ethics. There are technical aspects of all of these problems, but their solution is not so much a matter of technique as it is of right-mindedness.

There is certainly a new education on the way in which the emphasis will not be laid on technique, but on getting an attitude toward life and in which the actual technique will have to do with making the adaptations to life that are necessary if one is to take his proper place in society. Many of these adaptations go under the name of "citizenship" and most of them are social in their nature. In this new education safety will play an important part, for it has to do with the possibility of living a purposeful life which is the basis on which our social life must be constructed.

In the actual process of teaching it will be found (and this is the second approach that I referred to) that safety will find its place in nearly every course. It can be used as subject matter in reading, arithmetic, geography, nature-work (how plants and animals have solved the problem of safe living) and art-work, and it is particularly well adapted to dramatic presentation. All education should find an outlet for the child in practical activity. This is particularly necessary in such a subject as safety which is so obviously aimed at the practical conditions of life itself. In the school this takes the form of organizations of the children known

usually as "Junior Safety Councils." These are directed particularly toward the problem of safety of the children in their school life. One of their most valuable activities is the help that they give to traffic officers in getting the smaller children across the street in going to and from school.

RESULTS

It may be interesting to consider a few specific examples showing the effect of safety teaching. A small colored boy was one of a class in Springfield, Massachusetts, that worked out an elaborate project in fire prevention. Among other things the class made a trip to a fire station, and were taken to a fire alarm box and taught to ring an alarm. In their classroom work, in addition to the more usual activities, they also built a fire station and an alarm box. A few months later a fire broke out in the kitchen of the small boy's home. His mother lost her head and stood in the middle of the floor crying, but Nathaniel ran out and rang in an alarm, waited for the fire engines to come, and directed them to his home. The next day the father told the principal of the school that the action of the boy was undoubtedly all that saved his home from burning, a home that represented his entire savings.

A small boy in Detroit was on his way to school when he noticed a group of people that had collected about a man who was lying insensible on the grass. He had been overcome by leaking gas while making a gas-pipe connection. No one knew what to do for him. The boy, on the other hand, ran to the nearest telephone and notified the Public Service Corporation of the accident and where it had occurred. The Public Service Corporation soon had their trouble wagon on the spot and the man was resuscitated. The boy had learned what to do in his school work.

One of the subjects taught in the safety work of the Louisville schools is the prone pressure method. One of the boys who had had this work came from a particularly poor home environment. He was dirty, disobedient and usually late. During the summer John rescued one of his friends from drowning. He not only dived for him and got him out of the water but he worked over him for an hour and by the use of the prone pressure method finally resuscitated him. The Junior Safety Council had a special meeting in John's honor at which the Louisville Safety Council presented him with a gold star. The principal of the school later reported that this incident in John's life had completely changed his attitude toward school and toward life in general and that he had become a great help in

the social and safety activities of the school.

Such incidents which could be greatly multiplied serve to make one realize, as no abstractions can, how close this subject is to the heart of life and what a wonderful educational approach it may be when rightly used.

I have not explicitly referred to the industrial aspects of this subject, the reason being that safety education in the public schools is something that is still further underneath. It is obvious, however, that to give children an attitude toward life by which they come to appreciate that safety is a means by which they can live the best worthwhile life, is not only the basis but the only proper basis upon which can be built a fundamentally right attitude in industry.

The National Safety Code Program

By P. G. AGNEW

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JUST as state workmen's compensation laws led to systematic accident prevention work on the part of state commissions, so different rules issued by the several state commissions brought about the need for, and have led to the development of national industrial safety codes. Intensive work on a group of some forty national safety codes has been actively under way for the last six years. Of these, fourteen have been completed and issued and are now in use by industry and by state regulatory bodies.

DRAFTING NATIONAL SAFETY CODES

The method followed in the development of this safety code program, and the broad co-operative spirit underlying it, can best be illustrated by a specific example. The work of formulating a safety code for the protection of workmen in the use of grinding wheels was carried out by a joint technical committee made up of accredited representatives of all interested groups: the manufacturers through their national trade association; state commissions having regulatory authority over safety matters in the industries, or charged with the administration of accident compensation, through their national association; employing groups which are users of grinding wheels, through their respective trade associations; casualty insurance companies through their two national organizations; the workmen whom the code is designed to protect, this representation being arranged through the U. S. Department of Labor upon nomination by the workers' organizations concerned; national engineering societies; technical

bureaus of the Federal Government interested in the subject; and independent specialists. In all seventeen national organizations were represented on the joint committee, which had thirty members. After two years of careful and persistent work, unanimous agreement upon a complete code was reached, and it was issued as an American standard code. This code covers the general safety requirements to be met in the construction, care and use of grinding wheels. It is recognized as the authoritative guide to industry on the subject, and is being legally adopted by the various state commissions.

The other national codes are being formulated by this same general process and with the same care, through the systematic co-operation of all interested groups. After substantial unanimity is reached and registered by action of the joint committee responsible for any particular code, the code is formally certified as the "American Standard Safety Code,"—for Grinding Wheels, or for Punch Presses, as the case may be,—by the central organization which serves as a clearing house or means of systematic co-operation in the national industrial standardization movement—the American Engineering Standards Committee.

This Committee is the agency through which industrial standardization in this country is passing from group standardization by associations, societies and governmental agencies, to standardization on a national scale; and through its method and procedure the standardization work of the many bodies concerned is being broadened

and unified into a system of national industrial standards.

Safety codes form but one part, although a very important part, of the Committee's work which includes specifications for apparatus and materials; dimensional standardization of mechanical parts and supplies; nomenclature; methods of test, etc.

The work on the safety codes is under the immediate advisory direction of a representative committee of experienced safety experts, known as the Safety Code Correlating Committee. The functions of the Correlating Committee are to investigate the need for particular safety codes; to define and limit the scope of codes; to deal with the inter-relations of codes; to decide upon what organizations or groups should be represented on the technical committees; to follow up work in progress; and to act as a general clearing house for matters concerning safety codes. The largest group among the members of the Correlating Committee is naturally made up of representatives of state commissions; but there are also represented the organized insurance and safety groups, industrial associations, technical societies, and the Federal Government.

The work on individual projects developed under the procedure of the American Engineering Standards Committee is carried on in joint technical committees (officially called "sectional" committees), such as the committee for the safety code for grinding wheels, on which committees all the interests concerned in the standard are represented. In the case of safety codes this comprises the following groups:

1. Manufacturers (makers of the equipment).
2. Employers (purchasers, owners, users of the equipment).
3. Employees.

4. Governmental bodies having regulatory power or influence over the field in question.
5. Qualified specialists, such as staff representatives of technical societies, consulting experts with no exclusive business affiliation, and educators.
6. Insurance representatives.

Thus, the work of drawing up national safety codes is in the hands, jointly, of those who are responsible for the administrative and legal aspects of the problems involved, of those who have to face the technical, industrial and financial sides of the problems, and of those who have to face the hazards to life and limb.

After a safety code has been completed and issued as a national standard, the technical committee responsible for its development is continued in order to provide for revisions of the code, and to interpret the provisions of the code whenever the need arises.

There are two general classes of safety codes: those dealing with specific machines or devices, such as the codes for ladders, for punch presses; and those dealing with certain industries as a whole, such as the codes for wood-working plants, for foundries, for laundries, and for paper and pulp mills.

The existence of these two types of codes makes imperative great care on the part of the Safety Code Correlating Committee, to prevent conflicts between different codes. Through the efforts of this committee, it has been possible to bring about a considerable degree of uniformity in plan, arrangement and nomenclature between the different codes, notwithstanding the great variety of subject matter covered.¹

¹ See in this connection a brochure issued by the American Engineering Standards Committee, entitled, "The Preparation of National Safety Codes."

In the matter of state co-operation and support, leadership has naturally been taken by those states which are the more important industrially, such as Pennsylvania, New York, New Jersey, Wisconsin, Massachusetts, Ohio and California. The state of New Jersey, for instance, pursues the policy of adopting all safety codes developed under the procedure of the American Engineering Standards Committee and approved by that organization, and of revising their own codes previously issued in conformity with the national codes.

Functioning in the field of mining standardization is the Mining Standardization Correlating Committee, which is similar in organization to the Safety Code Correlating Committee. Much of its work is concentrated on mining safety codes. This work is carried on in the same general way as in the case of codes for factories. The organizations are, however, quite a different group, since mining is a specialized industry. This applies also to the state authorities, the responsibility usually resting with a state mining department.

From the point of view of the Safety Code Correlating Committee and of the American Engineering Standards Committee, the voluntary adoption of codes by industry is in the end as important, or even more important, than is the legal adoption of the codes by the several states. For the purpose, then, of reinforcing the knowledge of the codes which industry has acquired through the very method of their formulation, use is being made of trade associations, technical and commercial bodies, both local and national. In this the National Safety Council and its local councils are taking a leading part. Much is also being accomplished through the trade press, through correspondence and discussions at meet-

ings, and through a general educational program.

The desirability of uniformity in the safety codes enforced by the various states has been assumed. When one considers the interstate character of most of our industries, and the inconvenience and unnecessary loss in the manufacture, distribution and use of apparatus, resulting from conflicting requirements in the various states, no detailed argument is necessary.

The national safety code program which has been outlined, was launched as a result of prolonged consideration on the part of all interested groups, and after two large and thoroughly representative conferences held at the Bureau of Standards in 1919, at the last of which unanimous agreement was reached upon the general plan which has been followed.

It was inevitable that it should finally be recognized that engineering is at the very heart of the problem of industrial safety. But engineering could not render the services which it alone can render until this fact was recognized by the general public on the one hand, and upon the other hand, by industrial management itself.

This recognition was brought about by the educational results of the extensive safety movement which developed with the general introduction of compensation laws. Witness the group of papers in this volume of *The Annals* devoted to "Industrial Safety."¹

If the annual toll of accidents is to be cut down to the point to which it should be cut, safety must be woven intimately into the industrial fabric. That is, it must be reduced to a sound engineering basis. It is useless to tell an operator not to let his fingers get under a punch press if it is so constructed or operated that accidents are practically bound to occur. Safety

¹ Pp. 1-8.

education and organization, while necessary, are not sufficient in themselves. Safety features must be an intrinsic part of the design of the machine, and of the physical layout and operation of the plant.

The following is a list of the safety codes which have been completed and issued:

Code of Lighting Factories, Mills and Other Work Places.

Safety Code for Ladders.

Safety Code for Elevators and Escalators.

Code for Lighting of School Buildings.

Safety Code for the Use, Care and Protection of Abrasive Wheels.

Safety Code for the Protection of Industrial Workers in Foundries.

Safety Code for Power Presses and Foot and Hand Presses.

Safety Code for Logging and Sawmill Machinery.

Safety Code for Mechanical Power Transmission Apparatus.

Electrical Safety Code ("National Electrical Safety Code").

Automobile Headlighting Specifications—Laboratory Tests for Approval of Electric Headlighting Devices for Motor Vehicles.

Safety Code for Woodworking Plants.

Safety Code for the Protection of the Heads and Eyes of Industrial Workers.

Safety Code for Laundry Machinery and Operations.

There follows a list of the safety codes in preparation but not yet completed:

Safety Code for Building Exits.

Safety Code for Construction Work.

Safety Code for Floor and Wall Openings, Railings and Toe Boards.

Safety Code for Walkway Surfaces.

Safety Code for Mechanical Refrigeration.

Safety Code for Machine Tools.

Safety Code for Compressed Air Machinery.

Safety Code for Conveyors and Conveying Machinery.

Safety Code for Mechanical Power Control.

Safety Code for Forging and Hot Metal Stamping.

Safety Code for Plate and Sheet Metal Working.

Safety Code for Rubber Machinery.

Safety Code for Cranes, Derricks and Hoists.

Safety Code for Electrical Power Control.

Code on Protection Against Lighting.

Safety Code for Aeronautics.

Colors for Traffic Signals.

Safety Code for Automobile Brakes and Brake Testing.

Safety Code for Explosives.

Gas Safety Code.

Safety Code for Textiles.

Safety Code for Paper and Pulp Mills.

Safety Code for Tanneries.

Safety Code for Industrial Sanitation.

Ventilation Safety Code.

Safety Code for Exhaust Systems.

Mining Safety Codes

Safety Code for Rock-Dusting of Coal Mines.

Safety Code for Mine Explosives.

Safety Code for Coal Mine Transportation.

Safety Code for Coal Mine Illumination.

How Safety Codes Are Developed and Enforced in Pennsylvania

By CYRIL AINSWORTH

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WHEN Pennsylvania took up the work of developing safety codes, safety standards were practically unknown. Real pioneer work had to be done. The national safety movement was in its infancy and few were "sold to the idea." The state was not organized to carry out a program of safety. Compensation laws were very few in number and the manufacturer who had a broad enough viewpoint to realize that code development and enforcement would react to his benefit instead of to his detriment was very much in the minority. The pioneer work can be viewed with pride when consideration is given to the favor with which the safety standards of Pennsylvania are received and when it is realized that the basic procedure in code preparation is the same to-day as in the early days of the work. This basic procedure can be summed up in a few words; namely, development of codes by industry itself co-operating with the Department of Labor and Industry. The principle of having the co-operation of a reasonable number of employers and employees in an industry is fundamental in code development, as it insures the code's practicability and enforceability.

All of the safety codes and other regulations of the Department of Labor and Industry are developed in the Bureau of Industrial Standards. That is, this Bureau is the part of the Department with which industry co-operates. It is responsible for the collection of all the data necessary for the information of those engaged in the

work and for assembling the ideas suggested in proper form for presentation to the Industrial Board of the Department for approval.

CODE DEVELOPMENT

The first step in code development is the appointment of a representative committee of the industry involved. Such a committee cannot be truly representative unless there is real representation of both the employer and the employee. It is also customary to appoint technicians, engineers and other experts having special knowledge of the particular problem involved. The Bureau of Industrial Standards appoints one of its members to act as chairman of the committee, and to conduct the work in general. The broadmindedness of persons who are willing to serve on these committees has been most unusual. Personal questions have been entirely set aside and only advice which is for the benefit of the whole has been presented. This unselfishness has resulted in complete harmony, lack of delay and the best work possible.

Before the committee can actually take up its work, considerable data must be collected. This introduces two other bureaus of the Department into the work; namely, the Bureau of Statistics and the Bureau of Inspection. The Bureau of Statistics is called upon to furnish data concerning accident experience of the industry to be affected by the regulations. These data show the number of accidents which have occurred and the cause of them. It can

be readily seen that this information is very valuable as it enables the committee to know just what the problem is and the degree of importance of certain causes as compared with others. The only way a safety code can be sold to employers is to show them that it has been developed in direct relation to the accident experience of the industries. Regulations must be developed to meet actual conditions as they exist and the information furnished by the Bureau of Statistics goes a long way toward making the committee acquainted with the conditions.

The Bureau of Inspection is called upon to give the committee information concerning the conditions existing in the industry through the experience gained by inspections of individual plants and through the investigation of accidents which are referred to them by the Bureau of Industrial Standards. Certain inspectors, who by the special experience gained in their inspection work or by the training received before they were connected with the Department, are temporarily transferred to the Bureau of Industrial Standards to assist the committee in its work. This enlarges the research staff of the Bureau and enables it to make its investigations more complete and thorough. The special committee is kept in touch with these preliminary activities in order that it may be entirely conversant with the problem when committee work begins.

After the collection of data and the field investigations are completed, a tentative set of regulations are prepared simply as a basis for discussion by the committee which is called together in a series of meetings. The committee, from the material which it has at hand and from the tentative draft presented to it, develops a code which it believes is practical, enforceable and adequate. This code is then

presented to the Industrial Board of the Department for approval, which is the final stage in its development.

Here again the code remains in industry's hands, first, because of the organization of the Industrial Board and second, because of the method used by the Board in determining whether or not the code should be approved and recommended to the Department for promulgation. The Industrial Board is an organization created within the Department, the members of which are representatives of the various groups which make up industrial life. Employers, employees, women, the public and the state, each have their representative on the Board and, therefore, have an avenue for voicing their opinions concerning any phase of the Department's activities. The Industrial Board gives industry its second medium for participation in the development of a code, for if any part of industry is not satisfied with the work of its own committee which has drafted the code before the Industrial Board for approval, it can voice its objections to the Board through its own representative.

The method by which the Industrial Board determines whether or not the code should be approved is through public hearings held by the Bureau of Industrial Standards. The Bureau distributes copies of the code to all interested parties and announces dates for public hearings on the reasonableness of the regulations. The hearings are held in the parts of the state affected and the open criticism of interested parties is received. These public hearings enable the Board to find out what portions are unreasonable and impossible and to make recommendations for such changes as will make the code enforceable when adopted. Not all suggestions and criticism are taken by any means, as many are given with the

pocketbook as the only consideration. A sufficient number of suggestions, however, are received to strengthen the position of the Board in approving the regulations as being reasonable and adequate. The final approval given by the Board takes the code for the first time out of the hands of industry, and places it in the hands of the Department for enforcement.

ENFORCEMENT OF SAFETY CODES

True enforcement cannot be secured unless the co-operation of industry is secured. Under other conditions than this enforcement is merely a police job. Enforcement of codes for the purpose of preventing accidents is a co-operative proposition between industry and the Department with the Department as the director of the work and industry's advisor. To better understand this we must analyze the types of employers with which the Department must work. The first of these is the one who realizes the value of the safety codes of the Department in that they serve as a guide in determining what machines should be guarded and what processes should be changed to eliminate certain hazards. This type is absolutely sold on safety and is willing to abide by and carry out the provisions of the safety codes because it is good business to do so and because he knows that the procedure under which the codes are developed insures that they are reasonable and necessary. Needless to say this employer welcomes the inspectors of the Department because he expects to benefit by the visit. Enforcement in such cases is of course secured entirely through the employer himself with advice from the Department, instead of by activity on the part of the Department alone.

The second type of employer to be considered is the one who either has

been fortunate enough not to have many accidents of a serious nature, or has not had the subject of accident prevention presented to him in such a way that he sees the dollar and cents side of the movement. This type of employer does not carry out the provisions of the codes on his own initiative, but waits until the inspector arrives and makes recommendations. He is very reasonable in his attitude and complies with the recommendations without any murmuring. He simply desires to be shown and if approached in the right way and encouraged, will soon turn into the first type mentioned and carry out the provisions of the code on his own initiative.

Employer number three, who fortunately is far in the minority, is the type which requires the use of the big stick before he carries out any of the provisions of the safety codes. He is the type that usually looks upon the inspector as an intruder and his recommendations as a raid on the treasury instead of as a friend and profit maker. Many of this type delay in complying with the recommendations until they are brought into court by the Department and fined. Such action is the last that the Department desires to take, but in many cases it is necessary. Other employers in this group abide by the recommendations only because they know that failure to comply will bring drastic action. Enforcement, then, can truly be said to be a co-operative work, instead of a mere police job as so many believe it to be.

NEED FOR TECHNICALLY TRAINED INSPECTORS

To be in a position to properly advise industry as to the best methods of applying the provisions of the safety codes, a corps of trained men must

be provided and their work must be systematically done in order to reach all the employers in a given period of time. They cannot wait for a call from an employer for advice but, instead, offer their services at the time of regular visits. Some idea of the size of this problem can be obtained when it is considered that during the first six months of 1925, 58,739 visits were made, 11,193 being special inspections. The Bureau of Inspection is the organization which supervises the work of carrying out the Department's part of the co-operative enforcement scheme.

To be in a position to give this highly technical advice, the inspectors must have special training and experience. The inspection force of the Department has not always been made up of such specially trained men but, thanks to the present Governor and Secretary of Labor and Industry, it has been professionalized. New appointments are made strictly on a basis of the capacity of the individual without political consideration. Most of the new appointees have been graduate engineers, and the remainder men with long experience. The only members of the old force that remain are those who either had the special qualifications when appointed or who have acquired the necessary knowledge through their inspection work. Such a professionalized force makes the employer know that he is dealing with men who are capable of giving him sound advice and counsel and who can be respected.

Such service constantly causes new

problems to arise and it is necessary that the inspectors be furnished with such information as to enable them to handle such problems and to keep up-to-date with the new methods and practices which are being developed. Very carefully drawn standard practice sheets are being prepared, covering every phase of safety code enforcement. These will be revised from time to time as experience dictates. Technical papers on various phases of accident prevention work are distributed to the inspectors and lecture courses with compulsory attendance are given. All of this is necessary in order that the inspector may always be in a position to render the proper kind of service.

Enforcement of safety codes in Pennsylvania is not, therefore, a simple matter of police duty as one might expect. Code development and enforcement go hand in hand as a big part of the Department of Labor and Industry's program of co-operation with employers and employes in their larger problem of reduction of accidents. Code development furnishes industry with general information as to the best methods of removing hazards and enforcement points out the best way of applying such methods in individual establishments. The proper type of code development and enforcement can only result in the securing of the complete co-operation of employers and employes and it is only through such co-operation that we can hope to so completely develop the safety idea that industry will be able to constantly reduce its accident rate.

Safety Code Enforcement in Ohio

By THOMAS P. KEARNS

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THE enforcement of the Industrial Commission of Ohio's safety codes, insofar as it is necessary to invoke the authority of the law to secure compliance by the employer, rests with the Division of Workshops and Factories of the Department of Industrial Relations. Under a re-organization of all state departments which went into effect in 1921, the Department of Industrial Relations not only includes the Division of Workshops and Factories, which was formerly under the Industrial Commission, but also includes the Industrial Commission for Administrative Purposes, although the principal functions formerly exercised by the Industrial Commission are still retained by it and carried on independently of the Department of Industrial Relations. Among the functions of the Commission is that of formulating and promulgating such orders as the Commission deems necessary for "the protection of the life, health, safety or welfare of employes," which orders "shall be *prima facie* reasonable and lawful."

In accordance with the powers vested in it, the Commission adopted eleven codes as General Orders on January 1, 1924, which gave to these codes the same force and effect as statutory law. Letters were sent to all employers of record, advising them of the adoption of these codes. The letter contained a return postal on which was printed a list of the codes in force and a request to the employer that he indicate thereon such codes as applied to his work and return the card to the Commission, whereupon they would send him the codes indicated.

At the same time, the Factory In-

spection Force made a special effort to reach all employers to personally advise them of the adoption of these codes and to assist them in complying therewith. In most cases it was found that the employer was making a reasonable effort to comply with the requirements. Where the Inspection Force found an employer who was indifferent to the codes and had made no effort to comply therewith, a "special order" was issued ordering him to comply. Essentially this order was a warning, inasmuch as the special order simply affirmed that which was already legally obligatory. This was done in pursuance of the general guiding principle of the Commission to seek by means of persuasion rather than coercion to secure the co-operation of the employers in the application of the codes and the prevention of accidents. Where persuasion fails, the coercive measures provided by law are applied. As each instance of failure to guard and each separate day of delay constitute separate and distinct violations of the law, punishable by a fine of from \$50 to \$5000 for each violation, it is rarely necessary to resort to the courts to secure compliance. The enforcement thus briefly described is the only enforcement in the ordinary sense of the term.

In addition to the direct pressure so brought to bear on the employer to comply with the safety codes and to carry on accident prevention, there is an indirect pressure which arises from the provisions of the Ohio Compensation Law. A brief description of these will make clear the reason for their effectiveness.

PROVISIONS OF OHIO LAW

(1) In the first place, the Ohio Compensation Law is liberal: the death award is \$6500; cases of temporary and permanent disability are compensated after the first week at a maximum rate of \$18.75 per week; medical allowances are entirely adequate; many, even if not all occupational diseases are compensated on the same basis as are accidents. Obviously, where a compensation law makes such liberal provision for employees, the cost of having any accidents is high.

(2) In Ohio an employer must either insure with the Industrial Commission or carry his own insurance. Private insurance companies are not permitted to do any underwriting of industrial risks in the state. If the employer carries his own insurance, his accident experience of course immediately and directly affects his expenditures for accidents. By the system of individual merit rating which the Industrial Commission uses, the employer receives the maximum effect of his accident experience within the widest limits that sound insurance principles permit. Thus, if an employer has a bad experience, his rates tend to increase; if his experience has been good, the rates tend to decrease, ample provision being made in both instances to prevent violent fluctuations of the rates due to an ephemeral bad or good experience. The maximum variation from the basic or standard rate is 50 per cent, either upwards or downwards, or, in other words, between the limits of 50-150 per cent.

As the law provides that the entire cost of operating the Industrial Commission shall be charged against the general budget of the state, and that no profits shall be made by the Com-

mission, the insurance rates are fixed at a point that will just cover the compensation and medical costs. While this insures the lowest possible rate for the employer, considering the compensation and medical services which employees receive, the liberal provisions of the Ohio Law nevertheless tend to make fairly stiff rates. The combination of stiff rates and individual merit rating furnishes a decided incentive to the employer not only to comply with the codes, but to carry on effective accident prevention work in general.

(3) An amendment which became effective January 1st, 1924, the full effect of which is not yet measurable, but the action of which promises to be a factor of very great importance in securing compliance with the safety codes, is one which provides that an employer may be penalized from 15 per cent to 50 per cent of the normal compensation award by the Commission, if the Commission finds that the accident was due to the employer's failure to provide a safeguard specifically required by statutory law or the safety codes. *Against this loss he cannot insure excepting by providing the required safeguards.* In a death case, the penalty may be \$3250; in a permanent total disability it may be \$15,000, or more.

If, as has been repeated so often, it is necessary to touch the employer's money nerve in order to get him to do effective accident prevention work, then certainly the provisions of the Ohio Compensation Law should get results. As a matter of fact, though adequate statistics are not available, such evidence as is at hand clearly indicates that about the same amount of compensation is being paid at present as was paid a few years ago, notwithstanding that (a) employment has increased, (b) awards have been increased by somewhat more than 25

per cent; (c) the Compensation Law has been extended to include employers of three or more employes, where formerly only those having five or over had to insure. This one change alone added several thousand new risks to a list that has constantly increased since the very beginning of compensation in Ohio. Despite the increased number of employes, the increased awards and the additional risks, compensation has remained at about the same level, thus clearly indicating that a definite improvement has taken place. That this is a fact is borne out by the factory inspection force, who report greatly improved conditions to-day as compared with five years ago in all of the factories which they visit.

The Insurance Rating Department has also observed a constant downward tendency in the rates of the various classifications, notwithstanding the factors mentioned which would naturally operate to increase the rates. This downward tendency reflects the improved experience of the individual concerns making up the classification. For instance, the foundry rate was \$1.60 per \$100 of payroll in 1920 and only \$1.10 in 1925. If the increased awards which became effective in 1924 were considered, which raised awards somewhat more than 25 per cent, the reduction would be from a \$2.00 rate to \$1.10. Machine shop rates, which were \$1.25 in 1920 are \$.85 in 1925. It should further be noted in this connection that wages are, if anything, somewhat lower to-day than they were in 1920, so that if it were possible to make allowance for this factor, the results would be even more favorable than shown above.

EMPLOYER-EMPLOYEE COMMISSION CONFERENCES

In the earlier part of this article mention was made of the effort of the

Commission to get results through co-operation rather than through coercion. As special efforts have been made in this direction with excellent results, a résumé of the Commission's practices in this direction may prove helpful to others. Since the Industrial Commission Act of Ohio first went into effect, over a decade ago, there have been many changes made in the law,—strengthening, clarifying, broadening and making it more effective generally. These changes, almost without exception, have originated at conferences of employe and employer representatives sitting with the Commission at a meeting which is always held prior to each session of the State Legislature. Here employer and employe representatives put forward their proposals. By concessions and compromises an agreement is reached that certain changes in the Compensation Law shall be jointly recommended to the Legislature for enactment. These "agreed-on proposals" have invariably been enacted by the Legislature. Thus, owing to the good judgment, vision and leadership of the members of the Industrial Commission, particularly the Chairman, and the Secretary of the Ohio Federation of Labor and the Secretary of the Ohio Manufacturers Association, the Ohio Compensation Law has been gradually made into an ever more perfect instrument for the protection of employes and employers.

The same method of employer-employe-Commission conferences has been used in the formulation of the safety codes. In addition, these codes are given public hearings in the principal cities before their final adoption, thus giving employers and employes the greatest opportunity of making them perfect before their adoption. As a result of this method it is immeasurably easier to get the co-opera-

tion of employers and employes in the application of the safety codes than would otherwise be the case.

This spirit of co-operation has progressed to a point where the employers have agreed that one per cent of the premium which they pay to the Commission shall be used for the maintenance of a Division of Safety and Hygiene, functioning immediately and directly under the control of the Commission, whose duty it will be to carry on scientific research into accident causes and to elaborate and carry out far-reaching measures for their prevention. The formulation of new codes and the revision of those in effect will also be part of their work. This Division is already well organized. There is a superintendent and assistant

in general charge of the work; a statistical department is commencing to assemble the vast mass of material at hand; six safety engineers, all of them with years of experience in large factories and among them specialists in electrical, mechanical, steel and rubber hazards, are in the field, located at strategic points in the state; construction, mine and other safety specialists will be added, as well as a medical staff to advance industrial hygiene. Once more the old problem of reducing industrial accidents is to be attacked by a state department—but with a difference, a difference that the experience of the Commission has at least justified the trial of—the use of persuasion instead of coercion to secure employer-employee co-operation for safety.

Enforcement of Industrial Codes in Massachusetts

By ETHEL M. JOHNSON

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MASSACHUSETTS was the pioneer in this country in factory legislation.¹ It was the first state to appoint factory inspectors (1867); the first to establish a permanent bureau for the investigation of labor conditions (1869); and one of the first to create an industrial commission with authority to prescribe standards for protecting employes in industrial establishments from health and accident hazards.

In 1877, Massachusetts enacted the first American law requiring factory safeguards. This measure has served as the basis for much of the subsequent legislation for the prevention of accidents in factories and workshops. It provided that the belting, shafting, gearing, drums, and all machinery having movable parts in factories, workshops, mechanical and mercantile establishments, if so placed as to be dangerous to employes while engaged in their ordinary duties, should be securely guarded as far as practicable.

From time to time other specific safety provisions were added to the statutes. With the establishment of the State Board of Labor and Industries in 1913, the first general enabling act was passed definitely conferring upon the Board authority to formulate and enforce safety rules and regulations. These powers were at first exercised jointly by the Labor Board and the Industrial Accident Board. In 1916, the law was amended by transferring the entire responsibility for this work to the State Board of Labor. Three years later, when the Labor Board was abolished, this authority, with the other

functions of the Board, was transferred to the present Department of Labor and Industries.

THE LAW

Broad powers with respect to the establishment of industrial codes are conferred upon the Department. In addition to the enforcement of specific labor laws enacted by the General Court, the Department is vested with certain powers which are virtually of a legislative nature. The Department is authorized and required to make "reasonable rules, regulations and orders applicable either to employers or employes or both, for the prevention of accidents and the prevention of industrial and occupational diseases."

Provision for rules dealing with certain specific subjects is made elsewhere in the statutes. There is requirement that "every factory, workshop, manufacturing, mechanical and mercantile establishment shall be well lighted, well ventilated, and kept clean and free from insanitary conditions according to reasonable rules and regulations adopted by the Department with reference thereto." The Department is also required by law to make rules regulating the employment of women in core rooms of foundries.

The rules when adopted by the Commissioners of the Department have the force of law. The statutes provide that no person shall violate any reasonable rule, regulation, order or requirement made by the Department, and that if any person does so violate such a rule or regulation, he shall be punished by a fine of not more than one hundred dollars. The authority of the

¹ Commons and Andrews: *Principles of Labor Legislation*.

Department in this respect has been upheld by the Attorney General in an opinion given in May, 1921.

PROCEDURE

In order to make it possible to utilize expert knowledge in the preparation of a code, the law provides for the appointment of a committee on which employers and employees shall be represented to make investigation of the matters under consideration and to recommend rules and regulations to the Commissioners of the Department. While the law does not specifically state that there shall be an equal number of employer and employee representatives on the committees, that presumably is the intent. In addition to representatives from the trade, these committees usually include in their membership, experts in industrial health or in accident prevention work; as safety engineers, representatives of casualty insurance companies, industrial physicians, and specialists in the subject involved. Although it would appear from the wording of the statute that the Department is free to establish safety regulations without the agency of a committee, it is the practice in every instance to appoint a committee for this purpose.

Establishment of a code committee is usually the result of some investigation conducted by the Department, or of conditions encountered in the inspection work and inadequately covered by existing law. If the proposed rules are to deal with conditions peculiar to a given industry, it is the practice in appointing a committee to ask for representation from the organized branches of the industry where such organization exists. In connection with the preparation of rules for the painting trades, for instance, employer and employee representation was secured from the Society of Master House

Painters and Decorators of Massachusetts, and the Massachusetts State Conference Brotherhood of Painters, Decorators, and Paper Hangers of America respectively. The chairman of the committee was an industrial physician, especially acquainted with occupational toxicology. On the committee appointed to recommend rules and regulations for the lighting of industrial establishments, there were electricians, engineers, officers of insurance agencies, oculists, and as chairman, an illuminating engineer.

Under the law it is the five commissioners of the Department, the Commissioner, Assistant Commissioner, and Associate Commissioners, who appoint the code committees and adopt the rules and regulations. The Commissioners are not bound by the findings of the code committees. They may alter or modify the recommended regulations, or adopt independent rules if they see fit. The committee is an advisory body to assist the Department in work requiring specialized experience and technical knowledge of industrial processes and occupational hazards. As a matter of fact the standards proposed by the code committees invariably constitute the basis for the rules and regulations adopted by the Department.

Certain requirements have to be met before the rules become effective. Before the Commissioners adopt rules they must give a public hearing upon the proposed regulations. After the adoption of the rules, they must be published in the press at least thirty days prior to the date they go into effect. To insure that the rules adopted by the Department are "reasonable," provision is made for an appeal, first to the Associate Commissioners of the Department, then to the Superior Court. The Court is authorized to annul any order if it is found to

exceed the authority of the Department. No appeal of this nature, however, has ever been taken.

NATURE OF CODES

The authority granted by the Department to issue rules and regulations for the protection of the health and safety of workmen makes possible provision for safeguards against industrial hazards which could not be reached by general statutory requirements. It also makes possible the adjustment of the regulations² for industry to meet changing industrial conditions. The same authority exists for the revision of rules as for their adoption in the first instance. Adoption of an industrial code, however, does not necessarily mean that new restrictions are placed upon industry. It means usually that existing requirements have been made clear and specific. Codes are directions explaining how some of the general provisions of the labor laws are to be applied in particular industries or operations. For example, the law requires that employees in industrial establishments shall be protected from accident hazards. The methods for providing such protection are frequently too complex or too technical to be treated in detail in the statutes. The guarding of machinery, for instance, requires not only specific knowledge, but detailed provisions for different types of machinery. The specifications for guarding woodworking machinery are quite different from those for punch press tools.

CODES ADOPTED³

Acting under the authority conferred by statute, the Department of Labor

² Another important consideration in connection with industrial codes is that they establish uniformity in inspection procedure.

³ In addition to the codes specified above, the Department has issued certain requirements which, although not definite codes, bear some resemblance to the rules and regulations; as the

and its predecessor, the State Board of Labor, have adopted a number of industrial codes. General safety rules and regulations and machinery standards were adopted in March, 1917. They became effective with respect to certain provisions in three successive years, March, 1918, 1919 and 1920 respectively. These rules deal with power control transmission; the use of belt shifters, couplings and collars; the safeguarding of shafting, gears and sprocket wheels; control of set screws, keys and key seats; the protection of balance and fly wheels; and the construction of suitable rails and stair treads.

Another important set of rules of a general nature are those for the prevention of accidents in building operations. These make specifications as to supports for staging and scaffolding, provisions for guard rails, ladders and stairways, protection of floor openings, and provision for lighting and for temporary toilet and washing facilities on building operations.

Other codes adopted by the Department are rules and regulations governing compressed air work; those for safeguarding at point of operation woodworking machinery and power press tools; rules and regulations for toilets in industrial establishments; those relating to safe and sanitary conditions in foundries and the employment of women in core rooms; rules and regulations pertaining to the painting⁴ business; and a lighting code for factories, workshops, manufacturing, mechanical and mercantile establishments.

requirements for the care of employees injured or taken ill in industrial establishments, recommendations relating to the prevention of anthrax and for safety in the manufacture of benzene derivatives and explosives.

⁴ The code for the painting business has recently been revised. The new rules for the painting trades will go into effect in January, 1926.

The majority of these codes were adopted before the model safety codes formulated under the direction of the American Engineering Standards Committee were issued. The more recent codes—those relating to safeguarding woodworking machinery and power press tools, and the lighting code—have been influenced to some extent by the national codes. It is desirable that there should be closer correspondence with the Federal standards in the interest of greater uniformity among the various states and in the interest of securing for the individual state the advantages of the most expert knowledge on these subjects.

ENFORCEMENT

Since the codes have the force of statute law, the same penalty of prosecution for non-compliance can be invoked to support these regulations as in the case of specific legislation. In either case, however, that is a last resort. The successful application of the codes depends far less upon police work than upon educational work, voluntary co-operation, and constructive inspection and investigation.

The makeup of the code committees, in part from representatives of the organized branches of the industry for which rules are to be established, assists materially in this connection. It helps in securing the co-operation of the industry in the establishment of the rules. It helps also in the educational work which is essential for the successful application of the rules after they have been adopted. This co-operation comes largely through the dissemination of information regarding the rules among the members represented and through enlisting their support.

If the code is one which formulates specifications for guarding machinery of a certain type, the Department endeavors to secure the co-operation of

the manufacturers of these machines in equipping their products with the required safety devices before they are put on the market. The response to these efforts has been gratifying. Many manufacturers now equip their machines with belt shifters, guards for gears and sprockets, and point of operation guards. This is true of the manufacturers of many types of machinery, but particularly of the textile line.

Valuable assistance is also given by the various agencies engaged in promoting industrial safety work, the liability insurance companies and the state and local safety committees. Through their activities, greater interest has been stimulated among employers in the avoidance of accidents and in recognizing the importance, as a matter of enlightened selfishness, of equipping their plants with adequate safety appliances. This paves the way for the acceptance of the Department's requirements for the prevention of health and accident hazards.

A great deal of educational work is essential in applying new rules. This is recognized in the law through the provision for a public hearing, and for the publication of the rules a month prior to the date they become effective. The Department, however, does not confine its work to carrying out these requirements. Copies of the rules are printed and distributed widely throughout the industry affected. Press releases explaining the essential provisions of the codes are sent to papers in the sections where the industry is located. Sometimes radio talks are given to interest employes in the general subject of industrial safety and their part in promoting this work.

INSPECTION

The greater part of the educational work, however, is that performed by the industrial inspection staff—the

agency through which the Department enforces the safety codes as well as the general labor laws. There are thirty-six inspectors for this work including the chief inspector and four building inspectors, whose work is confined to inspection and investigation in connection with building operations. The other inspectors work in connection with the general labor laws and industrial codes. Several have had training in industrial health work. There are two physicians among the number. Their duties are the same as those of the other inspectors except when they are employed on a study of occupational diseases. Each inspector is assigned to a certain district and is responsible for the regular inspection work in that district.

This work involves much more than examination of machinery in industrial establishments and observation of general working conditions. That is the routine side of inspection. Constructive inspection work calls for definite assistance in the elimination of industrial hazards and stimulation of interest in accident prevention work. To accomplish this, the inspectors must be thoroughly acquainted with the standards for safeguarding machinery of the various types in use in industry and must be familiar with safe methods of operation employed in plants similar to the ones inspected.

In connection with their accident prevention program the inspectors assist in forming plant safety committees. They give talks on safety to factory foremen and mechanics, emphasizing the need of instructing new workmen in the safe operation of their machines, and the importance of inducing workmen to use the safety equipment provided. When new rules have been adopted, the inspectors explain their provisions to representatives of the plants in their districts affected by

the orders, pointing out what changes will be necessary to meet the code requirements. Whenever extensive alterations or new construction is required to meet the specifications, reasonable time is always allowed in which to make these adjustments, the length depending upon the nature and extent of the changes involved. Re-inspection visits are made to ascertain how the work is progressing and whether all the requirements are met.

Although it is necessary in some instances to institute court proceedings in order to secure compliance, the great majority of employers co-operate with the Department in carrying out the code provisions. For the year ending November 30, 1924—the most recent period for which these data are available—there were 382 cases entered for prosecution. Of this number only eleven involved failure to comply with code requirements.

INVESTIGATION OF ACCIDENTS

An important branch of the Department's safety work which has a direct bearing upon the preparation and application of the safety codes is the systematic investigation of industrial accidents conducted by the inspection staff. Through arrangements with the Department of Industrial Accidents,⁵ a daily record is secured of the accidents in industry. These lists are then examined and the cases selected for inquiry assigned to inspectors in the districts where they occurred. The type of industrial accidents studied by the Department are those that come within the following classification: fatal accidents; permanent disabling injuries; injuries to minors under eighteen years

⁵ In Massachusetts the Workmen's Compensation Law is administered by the Department of Industrial Accidents which is entirely separate from the Department of Labor and Industries which enforces the general labor laws.

of age; accidents occurring in the building trades; accidents occurring in establishments having an unusually high frequency rate; and occupational diseases.

During the past fiscal year,⁶ 797 industrial accidents and 132 cases of occupational disease were investigated by the Department. This year, a special study has been made of the 2965 industrial injuries to minors under eighteen years of age for the year ending June 30, 1924.⁷

In connection with accident investigations, the inspectors ascertain the following facts: name and address, age and length of employment of injured employe; nature, place, extent and cause of accident; if on a machine, kind of machine, whether of recent construction, whether guards were provided and used; and how the accident occurred. Accidents of a serious nature, due to inadequate or faulty machine guards, are brought to the attention of the manufacturers of the machines in question. This is done even when their place of business is outside the Commonwealth.⁸

The purpose of the investigation is to ascertain whether the accident resulted from violation of existing law or rules, and if not, what action is necessary to prevent recurrence. In this way the work of the inspectors may serve as the

basis for instituting new code requirements.

Some indication of what the proportion code enforcement represents in the general safety work of the Department may be gained from the following figures. In connection with the inspection work of the previous year there were 14,531 orders issued calling for compliance with labor laws and regulations. Of this number, 1980 had to do with guarding machinery; 1799 with building operations; and 1433 with the lighting code. That is, the orders concerning code requirements represented more than one-third of all the orders issued.

EFFECT OF CODES

What has been the effect of the codes on the accident frequency rate? No study has been made by the Department to determine this result. To do this it would be necessary to know from year to year the number of man hours of exposure to specific industrial hazards. In the absence of specific data of this nature bearing on the subject, however, the general indication is that the codes have contributed materially to the reduction of accidents in industry. Following the adoption of the machinery standards, and the codes dealing with specific point of operation hazards, there has been a marked decrease in the number of accidents these regulations were designed to prevent.

The section of the machinery standards regulations requiring encasing or otherwise guarding transmission shafting and covering inrunning gears and sprockets became operative March 20, 1918; the requirements for safeguarding belts and pulleys, on March 20, 1919; and the provisions relating to main power control, on March 20, 1920.

For the year ending June 30, 1918, the total number of tabulatable industrial injuries as reported by the

⁶ The year ending November 30, 1924.

⁷ These data are secured from the Department of Industrial Accidents whose fiscal year ends June 30th.

⁸ A recent instance is that of an English concern manufacturing extractors used by some of the Massachusetts laundries. These extractors were not equipped with suitable cover guards and constituted an accident hazard to employes. The Department wrote to the manufacturers urging them to provide guards on the extractors before sending the machines from their plant. They replied that they were taking up the matter with their local representatives and stated they would arrange to have all of their machines for delivery in the United States fitted with covers.

Industrial Accident Department was 77,505. This included 19,640 accidents due to machinery. Of this number, 16,113 were accidents at the point of operation. There were 934 on gears; 743 on belts; and 91 on projecting set screws, keys and bolts. The following year, total tabulatable injuries were 67,240 and the number of machine accidents 18,490. Of this number, 14,764 were accidents at the point of operation; 711 were on belts, 702 on gears and 49 on set screws and bolts. For the year ending June 30, 1920, the total number of tabulatable injuries was 65,488. Of this number, 15,307 were caused by machinery.

By this time all of the provisions of the machinery standards were in effect. It should be noted also that the period under consideration, June 30, 1917 to June 30, 1920, was one of increasing employment, especially in the metal trades. There was, however, throughout this period and particularly during 1920, a substantial reduction in the number of machinery accidents. The number of gear accidents in 1920 dropped to 563. When in 1922 the total number of tabulatable injuries fell to 51,109—due in part to the reduction in employment—there were 381 accidents on gears. When with increasing employment the number of tabulatable injuries advanced to 60,439 in 1924, there was a further reduction to 359 in the number of gear accidents. During the period from June 30, 1917 to June 30, 1924, there was a reduction in the total tabulatable injuries of 22 per cent. For the same period the reduction in gear accidents was 62 per cent.

The woodworking rules became effective in October, 1920, and the punch press regulations in February, 1923. Both codes deal with point of operation hazards. In 1920 the Department of Industrial Accidents for the first time

presented figures showing the mechanical cause for specific injuries. For the twelve-month period ending June 30, 1920, there were 217 permanent partial disability accidents on woodworking machinery and 333 specific⁹ cases in the metal working trades. As punch press machinery is responsible for nearly all the accidents in metal working, these figures may be taken as an indication of the injuries from this source. The corresponding figures for 1921, 1922, 1923 and 1924 are: woodworking machinery 169, 180, 224, 190; metal working machinery 285, 189, 284, and 237. It should be remembered in considering these figures that 1921 and 1922 were periods of employment depression, while 1923 and 1924 were periods of increasing employment. The proportion¹⁰ of total tabulatable injuries represented by woodworking machinery in 1920 and 1924 are 2.5 and 2.1; and for metal working machinery 7.5 and 4.4 respectively.

Since the adoption of the codes, point of operation accidents have materially decreased, and in the case of accidents on woodworking machinery, there has been a marked reduction in the degree of severity¹¹ of the accidents sustained. This is substantiated by the experience of the Department of Industrial Accidents as well as by the reports of inspectors of the Department of Labor and Industries. The indication is that the codes have contributed

⁹ Specific injuries on woodworking and punch press machinery are quoted here for point of operation only.

¹⁰ The total number of specific injuries from all causes was reduced 25 per cent from 1920 to 1924.

¹¹ One illustration of this is in the accidents on wood jointers and planers. The rules require the substitution of cylindrical heads in place of square heads on hand fed planes and wood jointers. Accidents on these tools now involve at most the loss of the tips of the fingers, whereas formerly they meant the loss of the entire fingers or part of the hand.

directly to this result. The primary purpose of the inspection work, however, is not so much to ascertain the effect of the codes as to assist in putting them into operation and to insure their enforcement.

The various agencies utilized for the enforcement of the codes are those just described—education, co-operation, inspection and investigation. The success of the codes, however, goes back to more fundamental matters. There are many problems involved. In the first place the effectiveness of the codes is dependent upon the care, intelligence and impartial judgment with which the personnel of the code committees is selected. The codes are industrial

laws. They affect powerful interests. If these interests are allowed to dominate the committees, the resulting codes will fail to afford the full protection intended. Again, if the standards for the inspection service are low—if any considerations other than the public welfare determine the appointment of members of the inspection staff—then there will be failures on the enforcement side. In the final analysis, the success of the codes—their effectiveness *per se* and the effectiveness of their enforcement—is conditioned upon the kind of labor officials who choose the members of the code committees, and establish the standards and qualifications for the inspection service.

Safety Code Enforcement in California

By JOHN A. MCGILVRAY

Chairman, Industrial Accident Commission of the State of California

THE problem of how to prevent industrial accidents in California has received a great deal of attention since 1916, when the first set of safety orders of the Industrial Accident Commission were adopted.

By the provisions of Chapter 176, Statutes of California, 1913, the legislature delegated to the Industrial Accident Commission the power, after hearing had upon its own motion or upon complaint, by general or special orders, rules or regulations, to declare and prescribe what safety devices, safeguards or other means of protection shall be well adapted to render the employes of every employment and place of employment safe, and to fix such reasonable standards and to prescribe, modify and enforce such reasonable orders for the adoption, installation, use, maintenance and operation of safety devices, safeguards and other means or methods of protection—which shall be as nearly uniform as possible—as may be necessary to carry out the laws and orders relative to the protection of the life and safety of employes in employments or places of employment. This authority carried with it the right to fix and order such reasonable standards for the construction, repair and maintenance of places of employment as will render them safe.

By this law the Commission has power to require the performance of any other act which the protection of the life and safety of the employes and their place of employment may reasonably demand. The Commission also has the power to declare and prescribe the general form of industrial injury

reports and all necessary information in connection with the same, necessary for the proper enforcement of the safety orders.

METHOD EMPLOYED

The method by which safety orders are adopted by the Industrial Accident Commission are as follows: *First*, a time and place for the holding of a hearing for the purpose of considering and issuing the safety orders is fixed. Notice of such hearing is published in several papers of general circulation throughout the state of California. It is provided by law that no defect or inaccuracy in such notice or in the publication thereof shall invalidate any general order issued by the Commission after the hearing has been held. *Second*, when the Commission, after the hearing either upon its own motion or upon complaint, shall have found that any employment or place of employment is not safe, or that the practices, or means or methods of operation or processes employed or used in connection therewith are unsafe or that adequate protection for the life and safety of employes in such employment or place of employment has not been furnished, it is empowered to promulgate such order relative thereto as may be necessary to render such employment or place of employment safe, and that will protect the life and safety of the employes in such employment and place of employment. The law provides that this order may direct that such additions, repairs, improvements or changes be made and such safety devices and safeguards be furnished, provided and used as are

reasonably required to render such employment or place of employment safe; and compliance with this order, within the time specified, is made mandatory, except that the Commission may, upon application of any employer or other person affected by the order, grant such time as may reasonably be necessary for compliance and may extend the time for such compliance when it is found to be necessary.

Whenever the Commission shall learn or have reason to believe that any employment or place of employment is not safe or is injurious to the welfare of any employe it can, of its own motion, or upon complaint, summarize investigate the condition, with or without notice of hearings and, after a hearing had, may enter and serve such order as may be necessary to correct the condition found.

The orders of the Commission are reviewable by the courts on *certiorari* only. Whenever it is found that the condition of any employment or place of employment, or the operation of any machine, device, apparatus or equipment shall constitute a serious menace to the lives or safety of persons about it, the Commission may apply to the superior court of the county in which such place of employment, machine, device, apparatus or equipment is situated, for an injunction restraining the use or operation of such equipment until such condition shall be corrected. The application for injunction must be supported by sufficient affidavits or other evidence showing that the use or operation constitutes a menace, but no bond is required from the Commission as a prerequisite to the granting of any restraining order.

When, in the opinion of the Industrial Accident Commission, a place of employment, machinery, apparatus, device or equipment is in a dangerous

condition or is not properly guarded, or is dangerously placed, the Commission has the power to prohibit the use thereof. This prohibition is evidenced by a notice to that effect which is attached to the machine, device or apparatus, and must remain there until removed by authorized representatives of the Commission after the particular equipment or place of employment is made safe and the required safeguards or safety appliances are provided, the use of such premises or equipment being prohibited while the notice remains.

By amendment adopted by the Legislature in 1925¹ every employer, workman or other person who, after the notices are attached, uses or operates such place of employment, machine, device, apparatus or equipment before the same is made safe and the required safeguards or safety appliances or devices are provided, or who defaces, destroys or removes any such notice without the authority of the Commission, is guilty of a misdemeanor.

The law provides that every order of the Commission, its rules and regulations made and entered, shall be admissible as evidence in any prosecution for the violation of any of the provisions of such orders or rules, and shall in every such prosecution be conclusively presumed to be reasonable and lawful and to fix a reasonable and proper standard and requirement of safety unless prior to the institution of the prosecution for violations of such order or rule proceedings for a rehearing thereon or a review thereof shall have been instituted.

Every employer, employe or other person who, either individually or acting as an officer, agent or employe of a corporation or other person, shall violate any safety provision or shall

¹ Chapter 383, Stats. 1925.

fail or refuse to comply with any such provision or part thereof, or who, directly or indirectly, knowingly induces another to so fail or refuse to comply, is guilty of a misdemeanor, and in any prosecution for the offense it shall be deemed *prima facie* evidence of a violation that the accused has failed or refused to comply with any order, rule, regulation or requirement of the Commission relative thereto, and the burden of proof rests upon the accused to show that he has complied with the safety provision.

ACTUAL ACCOMPLISHMENTS

In addition to the foregoing, the legislature has provided by general law for the regulation by the Industrial Accident Commission of the construction, operation and maintenance of elevators in buildings during the course of construction;² the regulation of scaffolding for the protection of workmen;³ the regulation of temporary floors in buildings in the course of construction;⁴ and the regulation of passenger and freight elevators.⁵

Under the general authority given to the Commission by the legislature under the provisions of Chapter 176, Stats. of 1913, above cited, there have been promulgated nineteen sets of general safety orders and three safety rules, as follows:

- Air Pressure Tank safety orders.
- Boiler safety orders.
- Electrical safety orders.
- Electrical Station safety orders.
- Elevator safety orders.
- Engine safety orders.

² Chapter 275, Stats. 1913, as amended by Chapter 332, Stats. 1921.

³ Chapter 48, Stats. 1913, as amended by Chapter 333, Stats. 1921.

⁴ Chapter 107, Stats. 1909, as amended by Chapter 590, Stats. 1911, and Chapter 334, Stats. 1921.

⁵ Chapter 74, Stats. 1917, as amended by Chapter 390, Stats. 1921.

General safety orders.

General Construction safety orders.

General Construction safety orders for the use of explosives.

General Petroleum Industry safety orders.

Laundry safety orders.

Logging and Sawmill safety orders.

Mine safety orders.

Mine Fire Control safety orders.

Quarry safety rules.

Safety Rules for gold dredges.

Shipbuilding safety orders.

Steam Shovel and Locomotive Crane safety orders.

Trench Construction safety orders.

Tunnel safety rules.

Window Cleaning safety orders.

Woodworking safety orders.

In addition to the above the Commission has issued four advisory pamphlets covering "Elementary First Aid Instruction for Employees in Industry," "Hazards in the Dry Cleaning Industry," "Hazards Ordinarily Found in Garages and Automobile Service Shops" and "Organization of Safety Committees in Industry." The above orders, while not codified, have to all intents and purposes the effect of a safety code.

The basis of the safety orders in California are, more or less, the standards set in some prior state or national code, proposed or adopted by the U. S. Bureau of Standards, the American Society of Mechanical Engineers, the American Engineering Standards Committee or like organizations. The modifications necessary to the local conditions are, in general, of no great significance and uniformity is not altogether lost; as, for example, the adoption by reference of the American Society of Mechanical Engineers' Boiler Construction Code, which is made a part of the Commission's Boiler Safety Orders.

It is the belief of the present Industrial Accident Commission of California

that safety codes are generally to be regarded as construction standards and that the proper method of enforcement requires co-operation with manufacturers of machinery and equipment. In stressing this the Commission is meeting with some measure of success, as certain correspondence given herewith will indicate. The Department of Safety of the Industrial Accident Commission, on the subject of standardization of color markings on compressed gas equipment cylinders, manifolds and hose, recently wrote to the American Engineering Standards Committee, of New York City, as follows:

We are attaching copy of minutes of the Industrial Accident Commission for meeting held May 6th, 1925, at which time it was resolved to formally request the American Engineering Standards Committee to undertake the standardization of color markings for oxy-acetylene equipment and similar equipment applicable to gas containers, manifolds and hose. This request supplements our letter of May 2nd and is in line with your suggestion of April 9th, in which you stated that the State Industrial Accident Commission would be classified as entitled to initiate a project.

We believe that the matter is of great importance and we will be pleased to have you notify us as to what action the committee cares to take in the matter.

The American Engineering Standards Committee replied to the foregoing letter as follows:

Your request of May twelfth was considered by the Safety Code Correlating Committee which met the day before the last meeting of the American Engineering Standards Committee. After a long discussion, it was decided to recommend to the American Engineering Standards Committee that a thoroughly representative conference be called to consider the proposal for the standardization of color markings for gas cylinders, and also the question of standardization of valve

threads for such cylinders. The latter subject has been proposed by the War Department.

This recommendation was considered by the American Engineering Standards Committee the following day, at which time representations were made to the Committee by representatives of the Compressed Gas Manufacturers' Association and the International Acetylene Association that the producers were not at present prepared to enter into the proposed undertaking. After a long discussion the Committee decided not to undertake the calling of a conference at this time.

It would of course be fruitless for the American Engineering Standards Committee to attempt to launch the work through a conference until such time as the manufacturers are willing to participate in a conference of the kind, since the work of national standardization, which means arriving at a real national consensus, cannot progress until the active co-operation of the producer groups is secured.

Regretting that this committee is unable at the present time to proceed with the standardization work which your Department has proposed, I am,

Respectfully,

(Signed) P. G. AGNEW, *Secretary*.

The foregoing is only one of the many instances that might be cited.

The Commission is stressing the desirability among architects and engineers of informing themselves as to the standards set by the Commission in order that they may write these standards in their specifications. More and more it is becoming the practice of these two professions to co-operate in this regard.

In the enforcement of the safety orders of the Commission a reasonable amount of field and shop inspection has been found desirable and necessary. This does not take the form of police work but is, rather, directorial. The field and shop inspectors do not pri-

marily seek enforcement by the use of the power vested in them of compelling obedience to the rule by "tagging" or arrest, but rather consider it their province to secure compliance by instruction and advice.

AID OF COMPENSATION INSURANCE

A powerful influence in safety work has been the experience rating plan of compensation insurance with its reduced rates for those establishments which show a good accident experience over the coverage period. In California the rates of compensation insurance for each industry are made up from actual statistics consisting of certain reports from every insurance company operating in the state and covering every occupational classification. These reports are then compiled under careful supervision and the results used to indicate what is known as the "basic" rate. This basic rate, however, is modified to fit the individual employer, depending upon whether the particular employer has, in the past, had a high or low loss ratio. When the employer, through accident prevention, succeeds in reducing the number and cost of injuries in his plant he obtains a very substantial reduction in his compensation insurance rate. Many employers are now receiving reductions in their rates of over 20 per cent, while reductions as high as 40 per cent are not uncommon. Obviously, the reverse is true in the case of an employer who will not take proper care of his employees, for he will receive an increase in rate, the exact amount being unlimited, depending entirely upon the actual loss experience.

The procedure in determining the rate consists of taking the actual loss experience and payrolls of an employer during the four previous years, but not including the year just expiring; in other words, an employer who

qualifies for an experience rating and who renews his policy during the year 1925 will receive a rating based upon his experience under policies issued during the years 1920, 1921, 1922 and 1923. The 1924 year will not enter the rating until the 1926 policy. The total payroll during these four years is then computed into the premium using the current rates, and the loss experience is totalled up and compared with the amount that is normally expended on a risk of the size under consideration as measured by the firm or actual condition. When the actual loss experience is less than the amount expended the result is a reduction in the rate but, on the other hand, when the loss experience is more than would be normally expected the rate must be and is increased. In this way, California employers are made to realize that not only is accident prevention humanitarian but that it is good business; that it pays in dollars and cents, for the employers' compensation insurance rates are based upon the actual experience of similar institutions, modified, as far as possible, to conform with their own individual plans.

The inspectors of the Commission are men especially selected after competitive examinations conducted by the State Civil Service Commissioner. In addition, all boiler and elevator inspectors employed by insurance companies and railroad and oil companies are required to pass an examination and be certified by the Industrial Accident Commission. There are approximately 93 boiler inspectors and 77 elevator inspectors, or a total of 170 inspectors so certified, employed in the state of California to-day.

SAFETY EDUCATION

Proper enforcement requires safety education. Industrial accidents are

regarded by too many as a more or less inevitable incident in the process of production, and so far as the parties most vitally interested (the employer and employe) are concerned, each believes the remedial measures necessary should be undertaken by the other.

Much can be accomplished by the employer alone to render the work less hazardous and through careful conduct of his enterprise he will draw the interest of his workmen to safe practices. Likewise, the worker by adhering to safe rules of conduct will convince even the most indifferent employer that safety pays.

The Industrial Accident Commission of California is stressing the educational phase of safety by promoting safety committees whenever the opportunity presents itself and, as stated above, has issued an advisory pamphlet on the organization of safety committees in industry, showing the necessity for organization, its work and form, and outlining the method of procedure in groups of from one to one hundred and fifty employes; in groups of from one hundred and fifty-one to five hundred employes and in groups of over five hundred employes. This pamphlet has been revised from time to time and is now in its second edition.

SPECIAL PROBLEMS

Special problems have confronted the Commission at various times in its safety work. One of these problems was the large number of accidents arising out of the petroleum industry, particularly the drilling of wells. The Commission developed a set of safety orders covering the production of oil which were the first orders of their kind to be adopted in the United States. Through the adoption and enforcement by the Commission's inspectors of these orders the accidents

in this particular industry have been reduced approximately 20 per cent.

In this industry one of the most hazardous pieces of apparatus used is the so-called "look-box." This is a device by which the changing condition of distilled petroleum products is observed during the refining process. A great many explosions from flare back have occurred in these look-boxes. At the present time, the Commission has under consideration certain orders to limit and safeguard the manner in which these look-boxes can be used in absorption and gasoline plants. Public hearings are called and the new orders will probably be made effective about the first of the coming year.

NECESSARY REVISION OF CODES

The safety codes need revision from time to time and it has been necessary to have adequate statistical information at hand whenever a revision is undertaken. In California, revisions of the various orders have occurred as follows:

Boiler safety orders, revised, effective November 1, 1925.

Electrical Utilization safety orders, revised, effective September 1, 1925, and issued as "Electrical Safety Orders."

Elevator safety orders, revised, effective January 1, 1925.

Construction safety orders, revised, effective January 1, 1924, and issued as "General Construction safety orders."

Mine Safety Rules, revised, effective January 1, 1921, and issued as "Mine Safety Orders."

These rules were originally adopted and made effective on January 1, 1916, and were the first rules or regulations covering metal mining to be adopted in the United States. Metal mining states, of which Utah is an example, have used these rules as a guide.

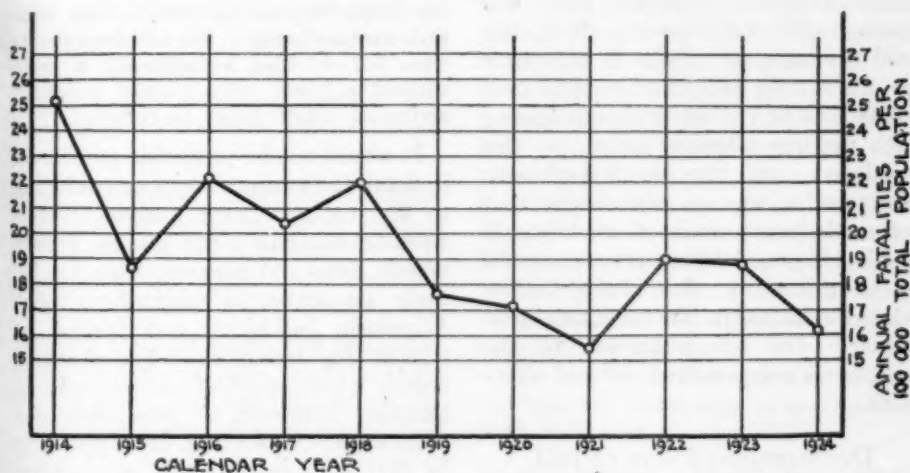
In the revision of the rules and orders of the Commission, committees of

employers and employees are asked by the Commission to serve with the engineers of the Commission to present proposed regulations to the Commission. When these proposed regulations have been presented the Commission then calls public hearings for discussion. All objections offered at these hearings are referred to the committees. When the committees' work has been completed and all of the objections have been reconciled, the Commission then fixes the date when the regulations are to become effective and, after that date, and the filing of certified copies of the rule or order with the county clerks of the various counties of the state, such rule or order is effective.

These revisions simply show that no code can be final. Changing conditions

require changes in safety rules. Methods of standardization change from time to time and any rule adopted is sooner or later out of date. Therefore, enforcement must be reasonable and not over-exacting on technical points. Equipment already installed or in use at the time the rule is adopted should be accepted on the basis of equivalent safety. Above all, safety rules should be applied with intelligence and reasonableness. This the Industrial Accident Commission of California is endeavoring to do and firmly believes that this policy conscientiously followed will achieve gratifying results. The following graph shows the tendency of fatal accidents in California from 1914 to 1924 in the ratio of the state's population:

CALIFORNIA INDUSTRIAL ACCIDENT COMMISSION
FATAL INDUSTRIAL INJURY RATE IN CALIFORNIA,
BY CALENDAR YEARS, BASED ON TOTAL POPULATION.



The Wisconsin Idea in Safety

By F. M. WILCOX and A. J. ALTMAYER

Chairman and Secretary, respectively, of the Industrial Commission of Wisconsin

IN 1911 the legislature of the state of Wisconsin enacted comprehensive legislation dealing with labor problems. It passed a workmen's compensation act which became effective in May, the earliest act in the United States to go into practical operation. At the same time the legislature created an Industrial Accident Board to administer this act. The Commissioner of Labor and Industrial Statistics was made *ex-officio* member of the new board. However, before the end of the legislative session, June 30 to be exact, the legislature consolidated all of the functions of the Commissioner of Labor and Industrial Statistics and the Industrial Accident Board, creating what was known and is still known as the Industrial Commission. Prior to that time no other state had attempted to consolidate all of the departments dealing with matters affecting labor, so this legislative act was an experiment. However, it was an experiment that seemed to bear promise of much benefit and has in practice been very successful in co-ordinating the closely inter-related administrative functions, particularly the administration of the workmen's compensation act and safety work.

DEVELOPMENT PRIOR TO 1911

In order to fully understand the significance of the 1911 legislation it is necessary to give a brief account of the miscellaneous safety legislation enacted at successive sessions of the legislature. Prior to 1887 there were a few scattered safety provisions on the statute books which were unenforced and probably

unenforceable. In 1883 the Wisconsin legislature recognized what other legislatures had already recognized, that labor legislation without a state agency to enforce such legislation was useless and ineffective. Therefore, in 1883 the Bureau of Labor Statistics had been created, which Bureau, however, consisted of one commissioner at a salary of \$1500 and an allowance of \$500 for expenses. The commissioner necessarily confined his activities to studying labor problems rather than actual administration. The report of the Commissioner of Labor Statistics for 1887-88 contained the following observation:

Previous to 1887 the law provided for one inspector but he was clothed with little final authority. If it had been otherwise, the old laws, as useless as a knife without a blade, were without penalties and could not, therefore, be enforced.¹

It would not be profitable to discuss in detail the various safety acts relating to fire escapes, corn huskers, wood-working machines, air brakes, emery wheels, fans and blowers, seats for female employes, *ad infinitum*. The Wisconsin legislation was typical of similar legislation in other states—merely a patchwork of successive legislatures. However, the evolution of a blanket safety provision first appearing in 1887 is interesting and instructive. This reads as follows:

All belting, shafting, gearing and hoists, fly-wheels, elevators and drums of manufacturing establishments so located as to be dangerous to employes when engaged in their ordinary duties, shall be securely guarded

¹ Report of Bureau of Labor Statistics, 1887-88, p. 12.

or fenced so as to be safe to persons employed in any such place of employment.

In 1898 important changes were made in this blanket provision, chiefly the omission of the words "manufacturing establishments" and the change of the phrase "when engaged in their ordinary duties" to "in the discharge of their duty." After the 1898 change was made, the sentence read as follows:

The owner or manager of every place where persons are employed to perform labor shall surround every stationary vat, into which molten or hot liquids are poured or kept, with proper safe-guards, and all belting, shafting, gearing, fly-wheels, elevators and drums therein, which are so located as to be dangerous to employees in the discharge of their duties, shall be securely guarded or fenced.

The court held under the rule of construction *eiusdem generis* that, because a previous sentence in the same paragraph limited its application to factories and work shops, this provision must be likewise limited.

The Commissioner of Labor Statistics was given power by the 1887 legislature to

order bull-wheels, fly-wheels, tumbling-rods, elevator wells, stairways, shafting or dangerous machinery of any kind to be guarded and protected so as not to hazard the safety of workmen or visitors.

From a casual reading of the above sentence it would seem that the Commissioner of Labor had blanket authority over all places of employment, but under the same rule of construction mentioned above a previous sentence pertaining specifically to factories and work shops was considered to confine the authority of the Commissioner of Labor Statistics to factories and work shops. In 1905 the legislature took away the common law defense of assumption of risk where the safety

statute above quoted was violated, and in 1911 the legislature added the following sentence to such statute:

The duty to guard or protect the machinery or appliances on the premises or place where said employe was employed in the manner required in the foregoing section, as well as the duty of maintaining the same after installation, shall be absolute. The exercise of ordinary care on the part of the employer shall not be deemed compliance with such duty.

COURT INTERPRETATIONS

Reference has already been made to the fact that the Supreme Court limited the application of safety regulation to factories and work shops. Mention should also be made of the interpretation of the statutory obligation placed on the employer to furnish a safe place of employment. The obligation of the employer under the common law was to furnish a place to work which was safe and free from danger as other persons of ordinary care in like business and under like circumstances ordinarily furnished. The Supreme Court held in a case decided in 1897 that the statutory obligation was essentially the same.² This interpretation was adhered to until the change in the statute in 1911 noted above, except for the declaration that, "If the guarding as ordinarily furnished be obviously dangerous, it will not be deemed sufficient."³

But in 1913 the Supreme Court, having before it the statute as amended in 1911, held that

the duty to guard is absolute and the exercise of ordinary care on the part of the employer cannot be deemed a compliance with such absolute duty, yet that statute is not to be construed to require such guarding of a machine as would prevent

² *Guinard vs Knapp-Stout & Company*, 95 Wis. 482.

³ *West vs. Bayfield Mill Company*, 144 Wis. 106.

its operation, or the abandonment of it in case it cannot be securely guarded. The true meaning and intent of the statute is that the appliances shall be guarded or fenced as safely or securely as is possible consistent with their continued practical use. The mere difficulty, or inconvenience, or impracticability falling short of preventing the practical operation of a machine, however, is not sufficient excuse for failure to comply with the statutory duty.⁴

THE 1911 SAFETY LEGISLATION

Reference has already been made to the 1911 change made in the 1887 statute to the effect that the duty of the employer to guard is absolute. At the same session of the legislature a comprehensive safety statute was passed which covered all places of employment with the exception of "private domestic service or agricultural pursuits which do not involve the use of mechanical power" and under authority of which the Industrial Commission has promulgated various safety codes to be discussed below. The essential sections of the statutes are as follows:

Every employer shall furnish employment which shall be safe for the employes therein and shall furnish a place of employment which shall be safe for employes therein and for frequenters thereof, and shall furnish and use safety devices and safeguards, and shall adopt and use methods and processes reasonably adequate to render such employment and place of employment safe, and shall do every other thing reasonably necessary to protect the life, health, safety and welfare of such employes and frequenters.

No employer shall require, permit, or suffer any employe to go or be in any employment or place of employment which is not safe, and no such employer shall fail to furnish, provide and use safety devices and safeguards, or fail to adopt and use methods and processes reasonably adequate to render such employment and place of

employment safe, and no such employer shall fail or neglect to do every other thing reasonably necessary to protect the life, health, safety or welfare of such employes and frequenters, and no such employer or other persons shall hereafter construct or occupy or maintain any place of employment that is not safe.

The following interpretation of the terms "safe" and "safety" was specifically included in the statute:

The terms 'safe' and 'safety' as applied to an employment or place of employment shall mean such freedom from danger to life, health, or safety of employes or frequenters as the nature of the employment will reasonably permit.

The authority of the Industrial Commission is found in the following statute:

The Industrial Commission is vested with the power and jurisdiction to have such supervision of every employment and place of employment in this state as may be necessary adequately to enforce and administer all the laws and all lawful orders requiring such employment and place of employment to be safe and requiring the protection of life, health, safety and welfare of every employe in such employment or place of employment and every frequenter of such place of employment.

The Industrial Commission was also given the power

to ascertain and fix such reasonable standards and to prescribe, modify and enforce such reasonable orders for the adoption of safety devices, safeguards and other means or methods of protection to be as nearly uniform as possible, as may be necessary to carry out all laws and lawful orders relative to the protection of the life, health, safety and welfare of employes in employments and places of employment or frequenters of places of employment.

Other sections of the statutes provide that all general orders shall take effect within thirty days after their publication in the official state paper, but that

⁴ *Krueck vs. Phoenix Chair Company*, 157 Wis. 266.

special orders shall take effect as therein directed. The statutes also give the Industrial Commission the power "to appoint advisors who shall, without compensation, assist the Industrial Commission in the execution of its duties."

Any employer or other person interested, either because of ownership in or occupation of any property affected by an order of the commission, may petition for a hearing on the reasonableness of such order. Such petition must point out specifically and in full detail the reason why such order is unreasonable. After a hearing, if the Industrial Commission finds that the order complained of is unjust or unreasonable, it may substitute therefore such order as it shall deem to be just and reasonable. Court review of the action of the commission is also provided for, so that if the petitioner is not satisfied with the decision of the commission he may commence an action in the Circuit Court for Dane County (the county in which the state capitol is located). However, the order is deemed to be *prima facie* reasonable so that the burden of proof is shifted to the plaintiff. Moreover, if he does not commence such action prior to the date that prosecution is commenced against him because of violation of a safety order, the order is deemed to be conclusively reasonable.

The reason for the abolition of detailed statutory regulation is rather obvious. The legislation was inadequate, incomplete and very shortly antiquated. Insofar as the blanket provision covering all dangerous machinery was concerned, the standard was vague and indefinite. The difficulty of detailed statutory regulation appeared first in the field of public health, where it was found necessary to create a state board of health composed of physicians with the authority to issue orders based on expert knowledge.

The difficulty of such detailed statutory regulation next became apparent in the field of railroad and public utility regulation and finally in the field of labor legislation.

DEVELOPMENT OF SAFETY CODES

Under authority of the comprehensive legislation described in the foregoing section, the Industrial Commission has issued approximately fourteen hundred general safety orders which are collected into what are popularly termed "codes." The first set of safety orders to be promulgated was issued under the title "General Orders on Safety." These orders were drafted by an advisory committee appointed by the Industrial Commission. This advisory committee was called a Committee on Safety and Sanitation and was composed of representatives of the Wisconsin State Federation of Labor, the Wisconsin Manufacturers' Association, Merchants' and Manufacturers' Association of Milwaukee, Consumers' League, State Federation of Women's Clubs, employers' liability insurance companies, certain safety experts of companies which had done the best safety work in the state, physicians, municipal officials, and experts of the Industrial Commission.

It is interesting to note that the committee used as a basis of preliminary discussion, rules that the Commissioner of Labor and Industrial Statistics had formulated for the guidance of factory inspectors. The Commissioner of Labor and Industrial Statistics in the last report which he made prior to the creating of the Industrial Commission stated:

The question as to where a guard is necessary, also as to what is a proper guard, rests with the factory inspector, whose duty it is to see that the laws are complied with. Naturally, difference of opinion frequently arises between the owner of the

plant and the factory inspector as to the necessity or practicability of a guard, and with a view to overcoming this annoying situation for both parties, the Bureau of Labor and Industrial Statistics has compiled these rules to be used as a standard in the providing of safeguards.

In getting the information for forming these rules, it was necessary to get representatives of all those interested in this subject to attend these meetings, where suggestions were offered on the necessity or application of a safeguard.

It will thus be seen that the legislature of 1911 and the procedure developed as a result of such legislation were the result of a natural growth and the outcome of past experience in the administration of the labor laws. The safety and sanitation committee, after many meetings, drafted a tentative list of orders and submitted these to a public hearing. In line with suggestions received at the public hearing, some changes were made in the orders and they were then finally adopted unanimously by the committee and recommended to the Industrial Commission for formal adoption as General Safety Orders of the Commission. These general safety orders were arranged in three groups. One group was captioned "Points of Safety Common to all Industries"; another group was captioned "Special Industries" (but really covering only wood working); and the final group was designated as applying to elevators.

It was first the idea of the commission that a general committee on safety and sanitation would be appointed, composed of representatives of the various interests and that this general committee would appoint sub-committees to deal with specific industries and phases of safety regulation. This first general committee appointed in 1911 did, as a matter of fact, appoint sub-committees, one for paper mills, one for

laundries, and one for sanitation. These sub-committees drafted orders to be submitted to the main committee and developed in like manner as the original safety orders first described. It is interesting to note that the orders on sanitation covered not only ventilation, toilet facilities and factory house-keeping, but also the subject of shop lighting.

However, it was soon found more feasible to form separate committees to draft orders pertaining to special industries or to special hazards. Thus a building code committee, a boiler code committee, an elevator code committee, an electrical code committee, and various other advisory committees were appointed by the Industrial Commission at various times from 1911 down to the present time. However, the procedure first developed in 1911 has been consistently followed in the adoption of all safety orders of the commission.

The legislature laid down the rule of reason in the pronouncement that

the term 'safe' and 'safety' as applied to an employment or place of employment shall mean such freedom from danger to the life, health or safety of employes or frequenters as the nature of the employment will reasonably permit.

The Industrial Commission believes that the only assurance of reasonableness is found in permitting the interests directly affected to draft the working rules under which they will operate. The commission does not believe that the legislature intended to lay down an ideal standard of safety which could be arrived at and determined by experts, giving no consideration to practicability. It is also clear, and the courts have so held, that the legislature did not intend to lay down the standard of ordinary safety or "reasonable" safety as understood under the common law,

but instead it has established the higher standard which is such safety as the nature of the employment will reasonably permit; in other words, such safety as the enlightened and progressive employer affords his workmen.

The men serving on these advisory committees have given a surprising amount of time at their own expense, which if paid for would have required expenditures much in excess of the appropriation granted the Industrial Commission by the legislature. These men, while they have looked at the work as a public service, have also had an immediate interest in it because of its vital importance in the future conduct of their business.

At the present time the following safety codes are in effect in Wisconsin. The order in which they are listed is the order in which they became effective.

General orders on safety and sanitation.
Building code (applicable to buildings built after the adoption of the code).

Boiler code.

General orders on existing buildings.

Elevator code.

Electrical code.

General orders on fire prevention (these orders cover chiefly the matter of house-keeping).

General orders on industrial lighting.

Refrigerating code.

General orders on acetylene gas manufacturing.

General orders on automobile lights.

General orders on school lighting.

General orders on quarries.

General orders on mines.

General orders on heating and ventilating (developed out of the general ventilation requirements found in the original sanitation code).

General orders on spray coating.

It will be noted that some of the orders apply to the field of public safety. This is because of the fact that in 1913 the legislature extended the

general requirements of safety to public buildings as well as to places of employment and gave the Industrial Commission authority accordingly. Likewise, in 1919 the legislature placed the obligation upon the Industrial Commission to prescribe standards for automobile lights.

ENFORCEMENT OF THE CODES

The Industrial Commission when it took over the functions of the Commissioner of Labor and Industrial Statistics also took over the personnel, including the so-called factory inspectors. They are now known as deputies of the Industrial Commission. At the present time there are ten of these men, each one being assigned to a certain district of the state. In addition to their work of inspecting factories, they investigate cases coming under the workmen's compensation act and any other matter with which the Industrial Commission is concerned. Besides these men who have specific districts assigned to them, there are various deputies possessing special training who operate out of the main office located in the State Capitol, such as the electrical engineer, mining engineer, boiler inspectors and elevator inspectors.

All of these deputies are furnished with copies of the codes containing the various general safety orders and at periodical intervals are assembled for conference at the main office, in order that interpretations of the codes may be uniform and in order that these men may exchange their experiences. They are impressed with the idea that they are not merely inspectors to ferret out violations of the statutes or orders of the commission, but are representatives of the commission delegated to assist employers to solve safety problems. They are instructed to always call upon the person in charge and make known

their presence before they make any inspection, so that the superintendent may accompany them and discuss various points as they arise.

In some states the field men are given the power to tag machines that do not comply with safety requirements, but in Wisconsin it is felt that it is wiser not to delegate this power. While in some instances it undoubtedly is true that especially dangerous machines should be immediately put out of use, there is also the danger of incurring the charge of bureaucracy and arbitrariness. The commission has sometimes felt the desirability of having the right to prohibit the use of a machine after an employer has been given an opportunity to appear before the commission and present his side of the case. The commission does have the power to issue special orders which become effective at once, prohibiting the use of a particular machine or building, but the penalty for violating such special order is no greater than the penalty for violating the general order previously in effect.

WORKMEN'S COMPENSATION AND SAFETY

While the fundamental purpose of the workmen's compensation act is to partially indemnify the injured workman for his loss of earning capacity at the expense of industry, another valuable result of workmen's compensation has been to promote and encourage the prevention of accidents. While this incentive may seem to be greater in the case of an employer who does not carry insurance, it is also very effective in the case of insured employers because of the fact that they receive credits for safeguarding various danger points and maintaining a safety organization. The 1925 legislature has also passed an experience rating bill so that insured employers will receive partial credit or

debit according to their accident experience during the past five years. Moreover, the Wisconsin Workmen's Compensation Act has a special provision known as the increased compensation provision which has had a powerful influence in promoting safety. This provision reads as follows:

Where injury is caused by the failure of the employer to comply with any statute of the state or any lawful order of the Industrial Commission, compensation and death benefits as provided in sections 102.03 to 102.34, inclusive, shall be increased fifteen per cent.

Where injury is caused by the wilful failure of the employe to use safety devices where provided by the employer or

Where injury results from the employe's wilful failure to obey any reasonable rule adopted by the employer for the safety of the employe, or

Where injury results from the intoxication of the employe, the compensation and death benefits provided herein shall be reduced fifteen per cent.

The law also provides that the liability of the employer for the increased compensation or increased death benefits shall be primary, and the liability of the insurance carrier shall be secondary. Therefore the employer himself must pay this increased compensation regardless of the fact that he may be carrying insurance.

This increased compensation provision may at first glance seem to be out of harmony with the fundamental idea underlying the compensation act, which is that an injured employe shall receive indemnity for his injury regardless of negligence on his part or the employer's part. However, when it is realized that under the statutes as they existed prior to the passage of the compensation act the violation of a specific statute was negligence *per se*, there is ample justification for this increased compensation provision.

Every accident report is examined with the view of determining whether the accident occurred because of a violation of a safety order. If it appears that it may have been caused by such a violation, a copy of the report is sent to a field deputy who makes an investigation and reports his findings to the commission. He also expresses his opinion as to whether he considers that the accident was as a matter of fact caused by a violation of a safety order. However, his findings and opinion are reviewed by the engineer in charge of the safety department and in extremely doubtful cases the commissioners themselves are consulted before a letter is written to the employer advising him that upon the record as it now stands the accident seems to have occurred because of his violation of a safety order. In this letter the employer is advised that if he does not concede liability for such increased compensation, he is entitled to a hearing at which he may present whatever facts he desires.

In the case of a serious injury the increased compensation may amount to a substantial sum, but even in the case of a minor injury while the sum itself may not be large, the fact that the employer pays it directly makes a deep impression upon him and acts as an incentive in promoting safe practices and safeguarding of dangerous points.

It has been the policy of the commission to adhere rather rigidly to the code requirements because, after all, they are essentially minimum standards and from an administrative standpoint, it

has proven to be more satisfactory to pass judgment on the reasonableness of the protection of the worker on the basis of a specific code requirement, than to pursue a policy which would encourage injured workmen to claim benefits on the basis of violation of the statute that—"All places of employment shall be made as reasonably safe as the nature of the operation permits."

The employer members on code committees have gone far in aiding the commission in such educational program as is necessary to convince management of the reasonableness of code requirements. And those employers who have devised adequate means for meeting code requirements have been ready to give this information to other employers with problems to solve. A most satisfactory type of co-operation, not only as between employers, but as between employers and the commission in the safeguarding of work places, has been an outstanding development.

The standards of to-day are not likely to measure up to the standards of succeeding years. Just as changing conditions have disclosed the necessity for changing standards in the past, so may we expect the state to maintain such development in the future that the fundamental purpose of adequate protection to the worker may not be neglected. The profit from right working relations is well recognized and the most highly successful employer is the one who lives on right and safe terms of relationship with his workers.

Safety in the Steel Industry

By CHARLES L. CLOSE

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IN dealing with this subject I shall have to dwell particularly upon the safety activities of the U. S. Steel Corporation and its subsidiary companies with which I am most familiar; but the earnest efforts which have been put forth throughout the entire steel industry in recent years to prevent accidents are analogous in most respects, and have been attended with marked results.

Those who have been closely associated with accident prevention work in the steel industry could hardly have dreamed not so many years ago that large steel mills, with all their involved risks and employing many thousands of men, could go a week, much less a month, without a disabling accident. Yet this is to-day a very common occurrence and it gives us every encouragement that some day, and we hope not in the far distant future, our fondest anticipation, that we can operate our plants without accidents, may be realized.

The intensive safety movement in the U. S. Steel Corporation had its inception in 1906, twenty years ago, when Hon. E. H. Gary inaugurated activities based upon sound and broad policies, which were designed to give more concerted study to working conditions, and to those things which would contribute to the happiness, health and comfort of the employees and their families. In his instructions to the subsidiary companies regarding the safety of employees, Judge Gary said:

The United States Steel Corporation expects its subsidiary companies to make every effort practicable to prevent injury to

employees. Much can be done by designing new construction and machinery with all practicable safeguards. Expenditures necessary for such purposes will be authorized. Nothing which will add to the protection of the workmen should be neglected. The safety and welfare of the workmen are of the greatest concern.

Very little real study at that time had been given to the industrial accident problem and it was necessary, therefore, to pass through an experimental stage in the development of this work. It was apparent, however, from the beginning that if real accomplishments were to be obtained in actually preventing accidents, the work must be carefully organized. There were no precedents which might be followed, except perhaps certain fundamentals which naturally govern the conduct of any undertaking, and there were practically no reliable statistical data available which could be used to any appreciable advantage in planning a safety campaign.

As an illustration of the dearth of information on accident prevention during the early days of our intensified movement, I might cite that some time after I had taken up safety work in the National Tube Company, a subsidiary of the Corporation, I was interested in ascertaining what consideration, if any, had been given to the subject nationally. I learned that an American Museum of Safety had recently been established in New York City to promote industrial accident prevention, so I visited this museum with the hope of finding there some useful information which would be of help to us in the

solution of some of our difficulties. Those identified with the safety movement are acquainted with this well-equipped museum as it stands to-day and know the important part it has played in the prevention of accidents, but on this occasion of my visit I was somewhat taken aback to find that, while it was in charge of a director, it occupied but a small room and that the exhibit was limited to a few German photographs of more or less simple safety devices. So, I decided that the only course to pursue was to continue to study our problem and endeavor to apply the necessary remedies.

INITIAL STEPS

The first step in launching the accident prevention activities in the U. S. Steel Corporation was to appoint a special committee to study the situation. This investigation later resulted in the appointment of a Corporation Safety Committee comprising officials of the Corporation and representatives from the larger subsidiary companies who had already given some study to the subject of accident prevention. This Committee has been continued through the succeeding years and still meets periodically to consider all phases of accident prevention activities, to study accidents, and to recommend remedial measures to prevent the occurrence of similar accidents.

The success of the work undertaken by the Corporation Safety Committee soon led to the appointment of other committees, both in the Corporation and in the subsidiary companies, which greatly increased the scope of the work and later the creation of a central station, the Bureau of Safety, Sanitation and Welfare, at the general offices of the Corporation in New York City, became expedient to further the efforts of the committees and all other endeavors of the various companies to

improve the condition of their employees. The Bureau carries on the administrative work of the various committees, conducts special investigations and conferences on important welfare subjects, and obtains and disseminates valuable information which keeps the subsidiary companies advised as to the latest and best methods in accident prevention, sanitation and welfare work in general. It was realized from the beginning that co-operation among those supervising this work was of the utmost importance.

In addition to the Corporation Safety Committee, each subsidiary company has a central committee of safety composed of representatives from the different plants of the company. The duties of these committees are similar to those of the Corporation's Safety Committee, but with reference to its particular company only. There are also plant safety engineers and committees composed of important officials of the plant whose duties are similar to those of the central safety committee, but with reference to their particular plant only; there are department and special committees consisting of foremen, master mechanics, and skilled workmen, who investigate particular problems; and there are workmen's safety committees from the rank and file of the mill, including even the foreigner who cannot speak English. The functions of these mill committees are to assist in establishing safer and better working conditions for the employees by making a study of the general conditions, departmental and occupational hazards and practices, and to encourage the co-operation of their fellow workmen in promptly reporting for correction any existing unsafe conditions or practices through which personal injury may result. These committees meet at least once a month for the purpose of making formal de-

partmental or interdepartmental inspections; also they review accidents, suggest remedies—physical or operating—and render full reports, with recommendations, to the chairman of the Plant Central Safety Committee. So far as is practicable the members of the plant committees represent the various occupations, and membership is rotated frequently in order that as many men as possible shall serve upon these committees. Up to the present time over 70,000 employes have served upon these committees, and there are now over 10,000 men so serving. This is in addition to 151 safety engineers and supervisors who devote their entire time to accident prevention work.

INVESTIGATIONS AND RESULTS

The initial investigation into the accident situation indicated, from the little experience that had been gained, that accidents were due principally to unguarded machinery and other physical conditions, and the belief prevailed for a time that to prevent accidents it was essential only to make certain engineering revisions in equipment design and to guard dangerous parts of machinery which had been responsible for serious and fatal injuries. Working on this theory large sums of money were appropriated and spent to make necessary physical corrections. Accidents were reduced but not to the extent anticipated, and it was realized by those who were carrying on the work that a more careful study into accident causes would have to be instituted.

An exhaustive investigation into the causes of accidents evinced that the human factor entered intimately into the situation and that from seventy to eighty per cent of all accidents were attributable to thoughtlessness or carelessness either on the part of the workman himself or his fellow workmen. This being true it was evident that, if

further progress was to be made, organized activities would have to be established not only to correct physical conditions but to teach the workmen the fundamental principles of self-preservation, to inculcate habits of care and forethought, to overcome careless practices, and to secure and maintain their interest and hearty co-operation in the work. The safety activities of the Corporation, therefore, have been governed by two prime factors—*engineering*, relating to the physical side, and *education*, pertaining to the enlightenment and instruction of employes in safe working methods. Both, we have found, are of the utmost importance and interdependent in securing the results desired.

The Corporation Safety Committee, after a careful study, prepared "General Requirements for Safety," pertaining to physical conditions, for the guidance of the subsidiary companies, which have been revised as occasion has demanded, and each company has prepared safety standards and specifications for plant construction and for the purchase and installation of machinery and equipment. When constructing a new plant or department, or when installing machinery or equipment, every effort is made to have safety given equal consideration with construction features so that all safety appliances may be properly installed with the completion of the new work. By so doing the protection of the workmen against the ordinary hazards incident to machinery operation is insured.

As has been cited above, the various safety committees, engineers and supervisors, who compose the plant safety organization, make careful surveys of all departments with the view of ascertaining any hazardous machinery or other unsafe conditions and offering recommendations for their correction. When it has been fully determined just

and more skilful operation. Neatness is a dominating factor and, where feasible, guards are made to look as much like a part of the machine as possible. In other words, the position of the operating man who is responsible for the production of a department or a machine is taken carefully into consideration and an endeavor is made to have all recommendations for safeguarding equally satisfactory from an operating as well as a safety standpoint.

EDUCATION

The safety educational work has covered a broad field of activity, including timely instruction at the time of employment; monthly departmental safety meetings attended by the entire department personnel, at which talks are given by foremen, safety supervisors and employes, accidents are reviewed, and safer and better working conditions generally are discussed; general safety meetings, rallies and picnics to which the employes and their families are invited; safety poster bulletins and propaganda which reach the employes through the medium of bulletin boards conspicuously placed throughout the plants; safety precepts printed on the back of, or inserted in, pay envelopes or on cards which are freely distributed; safety literature and motion pictures. Several safety motion pictures have been produced which tell a strong story in picture form and which can be understood by all. These motion pictures are used extensively at the plants and at large safety meetings attended by the workmen and their families.

All of these educational activities have played their important part in the reduction of accidents, but there is no question that close personal contact of department heads, or foremen, with their men is the most direct means of reaching and educating them, and appealing to them for their interest and

hearty co-operation and support in the work. Considerable stress, therefore, has been laid upon proper instruction of new employes and keeping the importance of accident prevention ever fertile in the minds of the old men. It is a matter of record that the new and inexperienced man is particularly susceptible to accident owing to his unfamiliarity with the hazards of his new occupation. At the time of his employment, the foreman under whom he is placed sees that he is carefully instructed relative to his new duties and all the hazards involved, and that he is fully acquainted with the safety organization, what it is trying to accomplish, where the dangers lie in his occupation and how to perform his work safely.

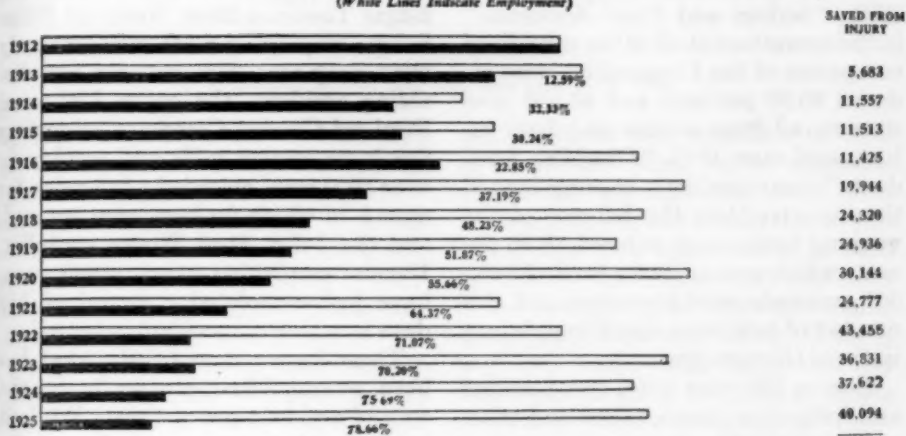
The department safety meeting, at which the foreman brings all his men together monthly for the purpose of discussing accident prevention measures, offers an excellent opportunity to fix firmly in the minds of the men the position and attitude of the company and their superiors with reference to the prevention of accidents, and to secure their co-operative interest. I believe that a great deal of the success of some of our largest companies in the prevention of accidents may be attributed to these departmental safety meetings, as they serve as a medium for the men to set forth their thoughts and ideas, and once the men are impressed with the importance of accident prevention and are impregnated with the safety spirit, many excellent and valuable suggestions are brought out for the correction of bad practices and accident hazards which might otherwise go unnoticed for a long period, or until an accident occurs.

ACCOMPLISHMENTS

The accomplishments of the Corporation and the subsidiary companies in the prevention of accidents, viewed

CHART II
PER CENT DECREASE IN DISABLING ACCIDENT RATE UNDER 1912

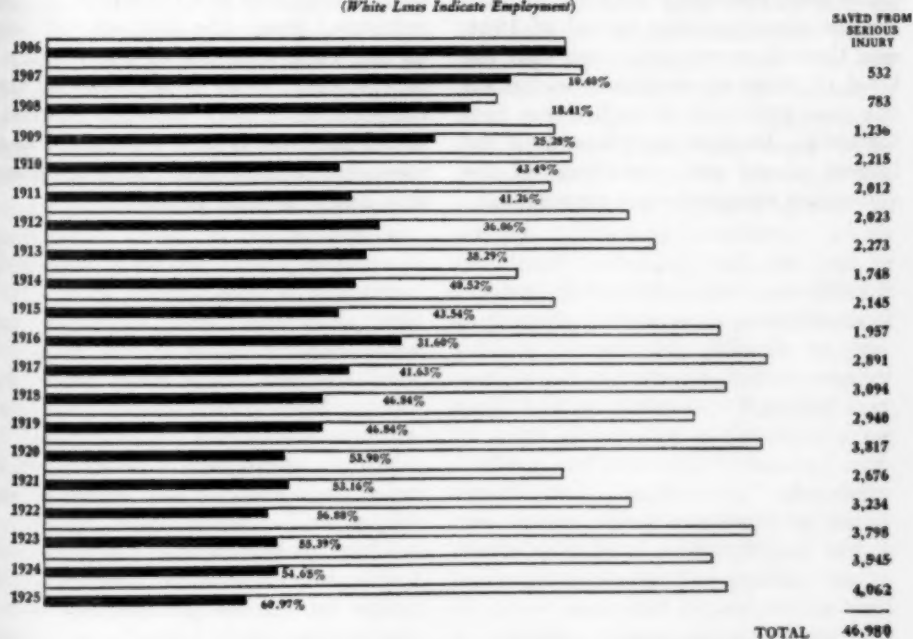
(White Lines Indicate Employment)



322,301 EMPLOYEES HAVE BEEN SAVED FROM INJURY IN 14 YEARS

CHART III
PER CENT DECREASE IN SERIOUS ACCIDENT RATE UNDER 1906

(White Lines Indicate Employment)



46,980 EMPLOYEES HAVE BEEN SAVED FROM SERIOUS INJURY IN 19 YEARS

from the standpoint of humanity alone, have justified every effort and expenditure. Since 1906, and up to the end of 1925, "Serious and Fatal Accidents" in the operations of all of the subsidiary companies of the Corporation were reduced 60.97 per cent and 46,980 men were saved from serious and fatal injury; and since 1912, "Disabling Accidents"—any accident causing loss of time greater than the balance of the working turn—were reduced 78.66 per cent, which means that a total of 322,301 accidents were prevented and this number of men were saved from injury in these thirteen years.

During the year 1924, two hundred and forty-nine plants, mines and other operations, with an average employment of approximately 132,000 men, produced an aggregate of 1511 full calendar months in which no accident occurred. In the first six months of 1925, there were recorded 841 such no-accident months, which record compares most favorably with 695 months for the corresponding period of 1924, and there is every indication that the total of these no-accident months for the year 1925 will be well above that for 1924. In these records some of the largest plants and operations of the subsidiary companies are represented.

As an illustration of the efforts that are being exerted to eliminate accidents in our operations, I might cite that the Edgar Thomson Steel Works at Pittsburgh, employing 6000 men, recently went sixty-nine days without one disabling accident; the entire Universal Portland Cement Company, operating five large cement mills and employing over 3600 men, recorded a full calendar month in which no men were injured; and the Joliet Steel Works at Joliet, Illinois, employing nearly 4000 men, have just completed a record of 116 days in which no accident occurred.

These figures show briefly what has been accomplished physically in the way of accident prevention. While it is impossible to estimate in figures the psychological value of safety work, there is no question of its effect on the morale of the personnel. The good results attending our efforts in the prevention of accidents I feel may be attributed to the interest maintained by the employes in all branches of the industry, from the highest officials to the rank and file of the workers. Safety work, while undertaken by the Corporation purely through humanitarian motives, is now recognized as a business proposition of enormous practical and economic value.

Safety in Coal Mining

By D. HARRINGTON

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THIS subject is much too extensive to be even fairly adequately treated in a short paper, consequently there can be given here only a partial summation of the writer's conception of "Safety in Coal Mining" after somewhat over twenty-five years' experience in mining wholly within the United States. Most of the time was spent in connection with health and safety but several years were spent in both engineering and in operating work, the experience involving underground work or observations in several hundred mines in more than twenty-five states of the Union. This paper will be devoted largely to pointing out unsafe conditions with suggestions—where available—as to what may be done to increase coal mine safety.

Coal mining is inherently one of the most dangerous of our major lines of occupation. Coal in finely divided form (dust) is readily inflammable and explosive, this being true of all coals except possibly the highest grades of anthracite; there is frequently encountered in all coal mines, or there is likely to be encountered at any time, gas which is very flammable and explosive; and in some instances there are found gases which are non-flammable but which quickly snuff out life by asphyxiation. The most dangerous gases given off in coal mines are invisible, tasteless and odorless, thus being peculiarly treacherous. The explosions in coal mines started by ignition of flammable gases or dusts and carried on, or propagated, usually by dusts, constitute a hazard almost exclusively confined to coal mining and the result-

ant accidents take numbers of lives at one time. While by no means as spectacular as explosions with their wholesale loss of life at one time, there are at least two other causes of fatal accidents in coal mines which take more lives over a period of years than explosions take, these two being "*falls of roof and coal*" with approximately four times as many fatalities as explosions; and "*underground haulage*" causing about one and one-half times as many fatalities as coal mine explosions. Falling of rock or coal from surrounding roof or walls, which as above indicated constitutes the greatest danger in our coal mines, is a hazard of a nature that confronts practically no other occupation than mining and as this menace affects practically every one of the approximately 700,000 underground workers in our coal mines at all times while they are underground and at every place they work when underground, it is by all odds the most difficult of accident causes to control. Haulage accidents, which rank next to falling roof and coal in number of fatalities, are also difficult to prevent, just as haulage accidents of various natures are difficult to prevent in our city streets and on country roads and on railroads. Ranking next in point of number of fatalities after "*falling roof and coal*," "*haulage accidents*" and "*explosions*," electricity now causes about one-tenth as many deaths as falls of roof and coal, but it looms as probably the greatest cause of future fires and explosions, as well as causing numerous electrocutions, etc., by contact, and unless greater

care is taken in the future in underground safeguarding as to electricity, it is not at all improbable that electricity will soon be the greatest hazard in our coal mines, as use of electricity is advancing in our coal mines by leaps and bounds. The use of explosives to obtain coal in convenient form to handle has been a prolific source of accidents, ranking about equally with electricity as a cause of fatalities; and like electricity, the use—or rather the misuse—of explosives has caused many fires and explosions most of which should be charged against ignorance or negligence.

In addition to the above enumerated causes of accidents, there are many other minor hazards in or around our coal mines such as falling into shafts or from high or steep places, accidents around or in connection with machinery, falling of objects other than roof and coal, surface accidents in connection with mine work, etc. These hazards, however, are of a nature met in many other occupations. In general, the loss of life from these causes is negligible as compared to the toll taken due to the previously mentioned causes which pertain peculiarly to mining.

CONTRIBUTORY FACTORS AGAINST SAFETY

With the above more or less serious accident hazards due to conditions largely inherent to coal mining, there are numerous contributory factors working against safety of mining and of mine workers. Safety knowledge is woefully lacking usually in both management and in mine workers; the laws with respect to safety in coal and other mines are extremely inadequate, loosely worded and out of date; even where laws are fairly adequate or up to date, enforcement is usually anything but efficient. Miners are prone to try to evade safety rules or

practices even when familiar with them and with full knowledge that evasions may result in loss of not only other people's lives but of their own as well. Managers and higher officials of mines rarely go underground, frequently know little or nothing of coal mining—having been chosen because of family connections to higher officials or because of being good executives—and even though ignorant of existing mining conditions and operations (including safety) don't hesitate to force instructions upon operating officials inimical to mine safety and often to mining efficiency. Sales officials wholly ignorant of mine safety frequently force upon operating officials underground methods and conditions decidedly unsafe. Cut-throat competition causes selling of coal at low prices, especially to large users, and mine costs are forced to be cut to overcome low selling price, safety generally bearing the brunt of the mine cost cut. These are but a few of the contributory causes to lack of safety in coal mines and, together with the inherent hazards, they indicate at least to some extent why our coal mines are not as safe as they should be or as they may be made.

It is very generally believed that the coal miner of many years of experience is best qualified to look out for his own safety or for the safety of the other miners, and where an appointment of safety inspector is made an old-time miner frequently is chosen. This is about the most foolish and most dangerous practice possible as far as promotion of real safety in coal mines is concerned. The miner is usually uneducated or at best poorly educated; he reads little or nothing and the usual extent of his knowledge as to mine safety is what he himself has experienced or what he has learned from some equally ignorant miner; he rarely

belongs to any safety organization or goes to any meetings which discuss safety; if he attends meetings of the union he hears chiefly discussions involving financial relationships or other controversies between the mining company and the men, and even if safety is discussed his union leaders are generally as ignorant of real safety as he is or they couple safety measures with demands for financial advancement. Possibly he is given safety instructions by the mine officials (fire bosses, safety men, mine foremen) but usually these officials are able to give him but little more safety information than the miner himself knows; and even where the mine officials give current safety instructions, these instructions can be carried out only by almost constant careful supervision and exercise of disciplinary measures by mine officials against the miner, especially if he is English speaking and experienced. And where the miner's union holds sway, discipline frequently is out of the question as regards safety measures as well as in connection with operating practices.

Our fire bosses and mine foremen upon whom our laws place the safety of the underground workers are miners who are usually somewhat better educated than the general run of miners or are more forceful or have some influential friends or relations. Usually these mine officials are required to pass an examination before being given a certificate of competency to act as fire boss or mine foreman; but only too frequently the examination is a farce and certificates are issued through intervention of influential friends. The coal mines of the United States have hundreds, probably thousands of fire bosses and mine foremen hardly able to read or write, yet possessing certificates supposed to have been issued after having passed an examina-

tion with many if not most of the questions of such a technical or theoretical nature that technically trained college graduates would be forced to the limit to pass. After the certificate is issued it is usually a life time notification of the permission of the state that the holder can act as fire boss or foreman, hence can be entrusted with the lives of hundreds of men. Usually this causes the holder of the certificate to consider that his knowledge of mining, including safety, is such that it is needless—probably many think it useless—to do any reading of current mining literature and as a consequence a large proportion of our mine foremen and fire bosses know even less of general mine safety than they did when they obtained their certificates five, ten, twenty or more years ago. At any rate, a very large percentage of them know woefully little of up-to-date safety methods or even of up-to-date provisions of state mining law. Both the fire bosses and the mine foremen are underpaid and overworked and while both are held legally responsible for the safety of the mine and the miners, usually they are amenable to instructions from higher officials who hold the purse strings and whose desires prevail irrespective of effect on underground safety, about the only recourse of fire boss or foreman being to resign if the instructions of the "*higher ups*" do not appear safe.

Mine superintendents who usually have full authority over foremen as well as fire bosses have practically no legal responsibility for the safety of the underground workers; at any rate they are seldom if ever required to have any certificate of competency. Frequently they are ex-clerks, or young engineers just out of school, or sons or other relative or possibly close friends of higher officials; and only too often, due to the erratic ideas of coal

mine superintendents who are almost wholly ignorant of mine operations or safety, unsafe underground policies or practices or equipment are forced upon the mine foremen or fire bosses and by them upon the underground workers. Similarly mine managers usually located in distant larger cities are frequently chosen because of being good executives, irrespective of lack of knowledge of coal mining, and certainly are seldom if ever appointed because of knowledge of safety. In only too many instances from their far distant office chair they dictate underground policies, even as to details, whose danger they themselves avoid as they seldom if ever endanger their own lives by going underground. Frequently the mine manager, even when capable and experienced in mining and familiar with his mines and the men in them, is forced by company directors or stockholders or owners to compel local mine officials to "*cut expenses to the bone*" to pay dividends or to increase them. A large amount of the lack of safety in our coal mines is due to interference of outsiders who never see even the outside of the mines and certainly do not in any manner endanger their own lives by going into mines made unsafe by their orders.

While our coal miners and coal mine officials usually have only an indifferent knowledge of mine safety, they very frequently consider the safety man as their natural enemy and it is often thought a very good joke "*to put something over*" on the safety man whether he is the state or federal inspector or even if he is an employe of the company. Generally the thing "*put over*" on the inspector is the concealing of some unsafe condition and in this, the mine officials and mine workers frequently are in accord and many bad accidents are traceable

directly to this criminal situation. The company safety man is very often a more or less dissolute employe who cannot be placed elsewhere; often he is a broken down old-time miner, mine foreman or mine superintendent, any of whom is certain to be a failure. An equally bad mistake is frequently made in appointing as company safety man, a young engineer—possibly some official's son or nephew or friend—only a year or so out of school, who probably makes foolish recommendations and soon becomes angered at the open or possibly the thinly veiled opposition of the usual hard-boiled bosses, and the young safety man soon has one main object and that is to "*get something on*" the local mine officials. Only too frequently the company safety man is considered a "joke" and this attitude is found even among the higher officials; in fact, in many coal mining localities safety men are considered "cranks"; and poorly advised appointments of safety men are largely responsible for this attitude.

State laws as to mining and especially as to mine safety are generally long since out of date and usually were inadequate when originally framed. When any attempt is made to amend the laws, there is almost invariably a clash of warring interests, sometimes miners against operators, sometimes inspectors against either operators or miners or both, or there may be—in fact, generally are—divisions of opinion or clashing of interests among operators. Usually mining companies are represented at these law-making meetings by lawyers or higher officials instead of those who are actually familiar with underground conditions. The result is almost invariably a compromise which is fine as to most laws in our system of government but is ruinous to safety in coal mines, since nature does not compromise when she

furnishes our mines with dangerous conditions.

Even when the law is fairly up to date, it is practically never enforced. Large companies generally do what they consider necessary as to safety and have sufficient influence in one manner or other to evade provisions of law which they do not care to carry out. However, the larger the company usually the more closely the adherence to the law as well as to sane mining practice and frequently the large companies far outstrip legal requirements as to safety. State inspectors freely admit that the smaller companies, especially when financially weak, are almost invariably inclined to evade complying either with the law or with safe, sane mining practice, and small financially weak companies are much more difficult than the large powerful companies to induce to take steps to comply with state law as to safety.

State mine inspectors usually are biased and show bias in their inspections and reports and only rarely are they even fairly efficient as safety inspectors. In most states they owe their positions to politics, either by being appointed by the governor upon recommendation of politicians, or operators or union officials or being elected by the vote of the people at large or by vote of the miners. In a few states they obtain and retain their positions by civil service system and the result is much better than the political appointment method, though even then the inspectors generally know only the rudiments of mine safety. Rarely if ever is the state inspector an engineer or other educated person who has made a study of mining; only too frequently the state inspector is more or less uneducated, or he is a more or less broken down cast off, having outworn his usefulness to some mining

company as miner, mine foreman or mine superintendent or has had experience chiefly as a labor agitator. He is usually very poorly paid and as previously stated he is generally biased either towards the unions or towards the employer. Absolutely impartial state inspection reports are the exception rather than the rule and the saddest part of the picture is that in many instances the bias takes the form of concealing or glossing over unsafe conditions or practices upon the part of the operating companies or of the miners or even of both.

Competition for coal business is undoubtedly a very potent indirect cause of mine accidents both large and small. Demand for lump coal causes many companies to use the very definitely dangerous black powder instead of the much safer permissible explosive. Demand for pea coal free of slack causes sprinkling or watering at the face to be discontinued or at least much lessened. Lack of demand for slack coal or occurrence of a little dirt in coal cuttings causes much slack coal to be left in mine workings, a very dangerous practice. In spring there is a demand for small coal sizes while lump is a "drug on the market," so some mines tell their miners to increase the amount of explosive used. Rock dust settling on lumps discolors the coal and customers "kick," so sales departments demand that rock-dusting be discontinued in certain instances. Large users of coal pit operator against operator in bidding for coal contracts and frequently the contract is taken below the cost of production with subsequent placing of pressure on the mine management to cut costs; and safety is almost invariably the first sufferer. Coal operators who have some advantage as to costs of coal production or who go out to get business at all hazards sell coal

at a very low price, some times lower than costs really allow, and thereby force other companies with higher costs to meet the low selling price or go out of business. Again the mine cost must be lowered and as usual safety is the first and severest sufferer.

Undoubtedly some of the most serious causes of coal mine accidents are poor methods of mining, including ventilation, haulage, blasting, timbering, laying out of mine workings, pillar pulling, selection and installing of equipment, etc., and while a large book could be written on the technical details of coal mining which influence or are influenced by mine accidents, this paper will in the following conclusions and suggestions give merely a few suggestions as to possible betterments, without attempting to enter into detailed discussions.

PERTINENT SAFETY SUGGESTIONS

(1) Approximately 850,000 employees in and around our coal mines have annual fatalities around or over 2500, serious accidents (incapacitating over fourteen days) well over 30,000 and slight accidents (incapacitating one to fourteen days) probably between 75,000 and 100,000.

(2) Falls of roof and coal cause approximately fifty per cent of total fatalities in coal mines; haulage accidents fifteen to twenty per cent; explosions of gas or dust or both cause twelve to fifteen per cent of coal mine fatalities; electricity and explosives each cause about five per cent of fatalities.

(3) The fatality rate of the coal mines of the United States per 1000 persons employed is two to three times as high as in the coal mines of Great Britain or France.

(4) Coal mining has numerous hazards which do not affect most other

occupations: dust of all coals, except possibly the highest grade anthracite, is both flammable and explosive; explosive gas is present or may at any time be present; and dangers from falling roof or side wall material are ever present. In addition there are essentially the same dangers from haulage that present such difficult traffic problems on surface streets; close contact must be kept underground with both explosives and electricity, each exceptionally dangerous; and modern mining demands use of much machinery under conditions which add materially to the inherent dangers from handling machinery.

(5) Where at all feasible long wall methods of mining should be used.

(6) Room and pillar mines should be divided into panels and panels connected to other panels or openings in as few places as possible.

(7) Mines should not be connected with each other.

(8) Not over 500 men should be employed in any mine and preferably not over 200 men if the mine "makes" gas.

(9) Where possible pillars should be "pulled" and pulling should start immediately upon completion of driving of rooms.

(10) Pillars should be held to a predetermined line, pulled clean, leaving few if any stumps, and before retreating from pillar face timbers, cribs, etc., should be removed or shot out.

(11) Mine territory not being actively used for extracting coal or for air or traveling purposes should be securely sealed.

(12) Concentrated systems of mining now being tried have numerous safety advantages, but the concentration of large numbers of men in a confined region introduces a very definite new hazard, especially where electricity

and machinery are used and gas or dust or both are present.

(13) All coal mines should have mechanically driven fan located on the surface out of line of the opening to the surface, in fire proof housing and should be so constructed as to be readily reversible.

(14) Mines which give off methane should have two sources of power for the fan or preferably a second fan with different source of power from the one generally worked.

(15) Booster fans should not be allowed in coal mines as they are merely a confession of failure of main ventilating system.

(16) Fan-tubing systems are dangerous in coal mines but if used, the source of fan drive should not be electrical.

(17) All mines should be divided into air splits with a minimum of 10,000 cubic feet per minute in each split (20,000 cubic feet per minute would be better) and there should be definite moving currents of air at and past all working faces.

(18) All cross cut openings except the last one (nearest the face) should be closed and the closing stoppings in cross cuts between entries should be fire proof and leak proof.

(19) Air circulation should be controlled and directed by fire proof stoppings, regulators and overcasts rather than by doors; the doors which are necessary should be of fire resisting material, tight and should close automatically. Every mine should have control and responsibility for ventilations under some one man.

(20) All coal mines should have a system of fire doors capable of isolating practically all main sections of the mine in case of fire. All mines should have underground water system for fire purposes.

(21) Moving of methane accumula-

tions while the working shift is in the mine should be absolutely prohibited.

(22) The term non-gaseous mine is a misnomer and it should be discarded and all the precautions now thought necessary for the most dangerously gaseous mine should be taken for every mine; even then our coal mines would be none too safe.

(23) Open lights and smoking should be prohibited in all coal mines and rigid search made for matches and smoking materials at frequent intervals.

(24) Flame safety lamps should be used only for inspection purposes and by certified men and should be of permissible magnetically locked variety.

(25) Placing flame safety lamp in the hands of more or less ignorant miners or machine runners is a criminal practice and should be prohibited.

(26) Electrical installations underground should be made fully as carefully as in surface buildings.

(27) Bare electric power lines should not be allowed in mines except as to trolley wires and where less than 6 feet above the rail, trolley lines should be boxed.

(28) Electric power lines should not be allowed on haulage entries unless well insulated and thoroughly buried in a trench.

(29) Electrical equipment in all coal mines should be exclusively of permissible variety where such is available, and it should at all times be kept in *permissible* condition.

(30) Permissible storage battery locomotives are safer than mules or trolley-crab locomotives and the latter should not be allowed to go to face region in mines having gas or dangerous dust nor should trolley locomotives be used in return air in gaseous mines.

(31) Haulage roads should be graded where local steep hills or hollows are

found and no prop or other obstruction should be allowed within two feet of track rail.

(32) Haulage ways should be kept clean of rock and lump coal as well as of fine dry coal dust, the latter being the most dangerous.

(33) Only solid type of mine cars should be used as leaky cars whether through floor, cracks in ends or sides, or loose gates, allow fine dry coal dust to sift through to haulage tracks and become decidedly dangerous.

(34) Black powder dynamite and fuse and squibs should be excluded from all coal mines.

(35) Shooting off the solid should be abolished.

(36) No explosive should be allowed in mines when the working shift is in the mine.

(37) All blasting should be done by shot firers after the working shift has left the mine.

(38) All shot firers should be required to be certificated after having passed an examination but little less rigid than the examination for fire bosses and mine foremen.

(39) The coal miner whether young and inexperienced or old and experienced is rarely if ever adequately acquainted with safety knowledge and needs education in safety; but above all he requires constant supervision and use of disciplinary measures to compel adherence to safe practices.

(40) Fire bosses, mine foremen and mine superintendents should be required to pass an examination every five years as to competency in safety in mining.

(41) Fire bosses, mine foremen and superintendents preferably should be mining engineers or at any rate should have had definite training in mining and especially mine safety.

(42) State mining laws should be brought up to date, should be made

specific—even drastic—and *should be enforced.*

(43) Federal inspection of mines by well paid, experienced mining engineers on a civil service basis would give real information as to mine safety.

(44) Company safety inspectors should be technically trained; should have at least five years underground experience; should be physically active and should be given operating authority to enforce safety instructions.

(45) There should be periodical, separate inspection of electrical installations underground, the work to be done by a competent electrician who is also acquainted with safety in mines.

(46) There should be annual inspection of mines by outside safety men; a good method would be to exchange safety men with mines in other districts or states.

(47) All mines whether gaseous or non-gaseous should adopt all available feasible precautions as to safety, since mistaken acts of omission or commission by management in coal mining are likely to cause wholesale deaths of employes, while in most lines of business mistakes by management merely mean financial loss.

(48) Every mine should issue to each of its employes a printed pamphlet (in as many different languages as may be necessary) summarizing the essential safety duties that each mine worker should perform for protection of himself and of his co-workers. Specific instructions should be given in this pamphlet to every class of mine labor including mine foremen, fire bosses, safety men, miners, drivers, hoistmen, trackmen, timbermen, machinemen, electricians, etc. This is rarely done and is one form of educational work that every mine owes its employes, as each worker is entitled to know what the company requires of him to insure his safety and the safety of his co-

workers, and at the same time what he may expect of his co-workers and of the company. The expense would not be great and if too great, the answer is that no mine should be allowed to operate which cannot afford to operate safely.

In conclusion it is strongly recommended that all mines rock-dust all dry open places except the face regions and use watering methods intensively at and around working faces. If this is done and open lights are excluded and mine workings are kept well ventilated, the dreaded explosion hazard at least will be pretty well eliminated.

A few years ago a doctor of the U. S. Public Health Service stated that the mining industry in the United States is at least twenty years backward as to protection of the health and safety of its employees. Possibly the statement was somewhat drastic, yet it undoubtedly has much basis in fact even at this time, hence this paper has been written with intent to bring out deficiencies rather than to call attention to numerous good practices, methods and equipment which are being used in the coal mines of the United States.

Safety in Mining—Other Than Coal

By JOHN L. BOARDMAN

Chairman, Bureau of Safety, Anaconda Copper Mining Company, Butte, Montana

THE mining of metals and minerals has been so closely associated with the advance of civilization that we cannot determine whether this advance was the cause of greater developments in mining, or that mining progress was the cause of increased civilization.

Some of our earliest historical writings indicate that certain of the metals were, even then, in great demand, and that the price in human life and human suffering which was paid in the mining of metals was then, as now, a subject of popular comment.

So much has been said already about accidents in mines, that silence would doubtless be more welcome than further repetition; however, attention should be directed to, and credit given, the efforts of modern mining men for the wonderful strides made in the past few years toward greater safety.

Mining was first done by picking up particles of metal in the beds of streams but the supply from this source was inadequate, and men soon learned to pick the loose pieces of minerals off the out-cropping ledges, and still later to follow these ledges underground, beating and picking off small particles, heating and quenching to crack the rock, and finally, through various stages of progress, to drilling and blasting. It would be impossible here to follow all of the details of this progress, but we can see on the one side a demand for metal amounting almost to greed and without regard for human life or suffering, and on the other a wonderful progress which includes nearly every advancing step

of mankind from the Stone Age to the aeroplane.

It is a long jump, even in imagination, from the slave in his breech-cloth, building a fire against the face of a dark and smoke-filled gallery, that he might throw water on the reddened rock and thus, by sudden contraction, spawl off a few particles of mineral, to the modern miner with his percussion drill and charge of dynamite or liquid oxygen.

OVERCOMING SILICOSIS

We are told by ancient writers that the mines were worked by slaves and prisoners of war, and that nearly as many overseers were required to beat the workers as there were miners to beat the particles of mineral from the mass; that the miners suffered from a disease which we now term silicosis, or miners' consumption. All down through the ages, miners, especially metal miners, have suffered, in addition to the ordinary dangers and hardships of their calling, from this disease, and it has probably been responsible for more premature fatalities than all of the so-called accidents put together. Therefore, when we speak of progress in safety in metal mining, we must include the efforts of mining men to overcome this menace.

Silicosis, until quite recently, had been taken for granted in connection with metal mining, but within the past ten years, such great strides have been made toward its elimination, that there is relatively little of it in up-to-date mining operations. The various steps through which this result is being

accomplished include: first, a thorough study of the disease, its causes and effects; second, the elimination of silica dusts; and third, the early recognition of symptoms and proper treatment of patients. Mining companies all over the world are now spending millions of dollars for machinery with which to ventilate their mines, thus carrying away harmful dust. They are scrapping millions of dollars' worth of valuable drilling machinery and spending other millions on new water feed equipment, which practically eliminates dust while drilling. Working places in mines are being piped for water supply, and miners are being required to sprinkle and wet down their working places after blasting, and to sprinkle and wet down manways, drifts and other traveling ways, to eliminate the harmful dusts. If the present efforts are kept up and a sufficient degree of co-operation between the miners and their employers is maintained for a few more years, we hope to be able to say that silicosis, or miners' consumption, has been completely conquered. It will probably never be entirely eliminated, because different individuals show different susceptibilities, and silicosis may be found in such occupations as farming, etc., but the mining industry is showing a remarkable progress in its control.

GENERAL SAFETY CONTRIBUTIONS

In setting forth even a brief outline of what has been accomplished toward greater safety in metal mining, we must consider what each branch of science or art has contributed, and in order to do this in an orderly manner, we may submit the following:

The chemist has developed explosives used in mining to a point of efficiency and safety which makes these useful tools of the miner practi-

cally harmless, both with regard to sensitiveness to premature detonation and the nature of resultant gases.

The physician has made available to the mining public the results of his studies into the physiological effect of mine air and the various kinds of dust found in mines. He has also developed methods of treating cases of injury and other disabilities arising from the occupation of mining, which greatly minimizes the ill effect of such injury and disease.

The electrical engineer has contributed his knowledge and skill to the control of electric currents and electrical apparatus, so that they are practically as safe for underground use as they are anywhere else.

The mechanical engineer has developed machinery which is nothing short of marvelous in its speed and efficiency, and which enables us to produce a very greatly increased tonnage at a less actual injury hazard than ever before known.

The mining engineer has worked out methods of extracting ores which enable us to recover an extremely high percentage of the ore body with practically no disastrous results to life and limb.

The ventilation engineer has shown us how to avoid the harmful dusts and gases incidental to underground mining, by developing means whereby pure fresh air is now supplied right up to the working places.

The ordinary miner of to-day has developed into a wiser, more efficient, more capable and more skillful individual than were the renowned sages of earlier days.

The mine operator, a combination of all of the others named, has been the cutting edge of the wedge which has forced itself into better days for mining. He has been at the forefront of every effort to improve the industry,

sacrificing, in many cases, his last dollar on the altar of safety.

Some of the details which have been followed in attaining the present status of safety in metal mining have been the invention and adoption of wet drilling; the almost universal use of mechanical ventilation; and the introduction of safe mining methods. When it was found, through study of accident causes, that men are liable to fall down shafts, raises and chutes, these places were guarded, and the danger thus practically eliminated. Accidents from falling ground and rocks have been greatly diminished in frequency by the use of proper timbering methods and by removal of loose overhanging rocks before the miner is permitted to work under them. Underground machinery has been so guarded that it is nearly as safe as when used on the surface in daylight. Many, we might say nearly every mining operator, now carries on a constant propaganda of education and admonition regarding the safe conduct of the work.

One of the outstanding mine safety developments of recent years has been the invention and introduction of the self-contained oxygen breathing apparatus for use in controlling and extinguishing mine fires. This apparatus enables us to accomplish a very dangerous operation in comparative safety which, a dozen years ago, was con-

sidered one of the greatest menaces to the life of a miner, *i.e.*, the control of an underground fire.

IN CONCLUSION

In summing up this rather rambling sketch of safety efforts in metal mining, we wish only to emphasize the fact that mining has always been considered one of the most hazardous of industries; that the demands of our rapidly advancing civilization have placed such a requirement of speed and complicated operation upon this industry as to make its present state of development a marvel of efficiency and skill, but at the same time we have left no stone unturned in our search for greater safety for the man who does the work; and we may say that all protective devices and methods so far brought forth for the mining industry have been adopted, regardless of cost, as soon as, and frequently even before, their efficiency has been proven.

The net result of the safety movement in metal mining has been that this industry has been changed, within the past twenty years, from the class of the most hazardous, to one of comparative safety; to where a man may now reasonably expect to follow mining as a life calling and to live and enjoy life through as many years as may a worker in the so-called semi-hazardous industries.

Safety in the Cement Industry

By HENRY A. RENINGER

Special Representative, Lehigh Portland Cement Company, Allentown, Pa.

THE Cement Association or, as it was called in the early days, the Association of American Portland Cement Manufacturers, was one of the pioneers in safety work. As early as 1912, the president of the Association appointed a Committee on Accident Prevention and Insurance and under their direction the Independence Inspection Bureau was engaged to make a study of the cement industry and each month to issue a bulletin which gave a very clear idea of the safe practices to be used in the manufacture of cement and showing the types of guards to be used on cement machinery. These bulletins covered every department of a cement plant and were most valuable for those who were starting in safety work. This was before many states had any safety codes or compensation laws.

November, 1914, the Department of Accident Prevention and Insurance was organized as a separate and distinct branch of the Association's activities. It was established with the purpose of carrying on the Association's work in accident prevention, which up to that time had been handled by the Independence Bureau of Philadelphia. It also took to itself all of the office work in connection with the compiling of accident statistics from the accident reports received from various member companies.

After the completion of the work of the Independence Inspection Bureau, Mr. Hill, Secretary of the Accident Prevention and Insurance Committee, started the publishing of accident prevention bulletins, which has been car-

ried on since that time under the able direction of Mr. Jacobsen who succeeded Mr. Hill, who resigned from the Association to enter the army, and whose untimely death brought sadness to all who knew him.

The early history of the committee shows that great efforts were made to get the various companies interested in safety work and to report their accidents to the Association. In 1914, 41 plants reported their accidents. It was necessary for the secretary to visit the different companies and urge them to take up this work and report their accidents. In 1915 the committee endeavored to obtain the number of men employed at the various mills, and a questionnaire was sent out, but only 29 companies furnished the information, and it was not until 1918 that the man-hour reports were obtained.

Safety in the Lehigh Valley District was given its start with the organization of the Lehigh Valley Safety Council No. 5, of the National Safety Council of Industrial Safety, in 1913, and all of the companies in this district are co-operating in every respect with the Bureau of Accident Prevention and Insurance of the Cement Association and the National Safety Council.

Our early experience—like all other hazardous industries—was filled with many horrible, needless accidents, due to the carelessness of all; but time and effort on the part of the Accident Prevention Committee and the secretary succeeded in the year 1924 in having 110 plants report their experience for that year. It has taken years of hard work for those companies which started

in in the beginning, to bring their accident record down to what might be called a minimum.

Compensation insurance rates are based upon the experience of cement plants or any other industry; and the lower the accident rate, the lower the premium. This means not only the saving of money, but what is more important, the saving of human life and limb. Twelve years have made a great change in our industry and those of you who have taken time to study the accident report of 1924, have seen the change in figures of days lost. Ten years ago all companies were paying their premiums to the insurance companies; to-day quite a number of the companies are self-insurers and laying aside a nice saving each year. This can only be done, however, by real, active safety work and by reducing accidents to a minimum. Self-insurers are accomplishing several things to help their organizations. They are keeping right after their accident prevention work, and as self-insurers, the company through its safety department and superintendents keeps in closer touch with the injured employee. Better and quicker service can be rendered in the handling of the cases and the paying of claims.

At the present time 80 per cent of the members of the Association are members of the National Safety Council and getting the benefit of its experience. The Cement Section of the Council is strong and active and at the Congress held in Cleveland in October, this year, 75 representatives were in attendance at the meetings.

The Cement Association is recog-

nized as having the best accident statistics report of any industry in the United States. This has been said many times by commissions of labor and industry and by the insurance companies themselves.

Mr. Lansburgh, of the Department of Labor and Industry of Pennsylvania, in his speech to the Cement Section at the Congress at Cleveland this year, made the following statements:

The Department of Labor and Industry of the state of Pennsylvania has a very warm feeling for the cement industry; not because of the few accidents in the cement industry but because your industry is thoroughly organized for accident prevention work and has gathered statistics which indicate what is going on. We are constantly taking the data furnished by you to executives in other industries and saying to them, "Can't you possibly get together on this basis, can't you do the same thing?"

Using the cement industry data we did go to the steel companies in Pennsylvania last year and for the first time obtained exactly the same kind of statistics from them.

Outside of these two industries we have not the slightest idea of where we are going because we don't know the exposure in terms of man-hours worked.

These statistics on accident prevention, as compiled by the Portland Cement Association, are very worth while and we are submitting here the comparative figures for six years on the basis of loss per 100,000 man-hours.

In another table on the experience of six years showing accidents and days lost by groups, we find that the best 25 per cent of the plants have made a remarkable gradual reduction from

	1919	1920	1921	1922	1923	1924
Accidents.....	4.35	4.38	4.24	4.17	4.16	3.53
Days lost.....	69.2	75.1	68.5	67.4	74.5	61.4
Permanent disabilities.....	0.14	0.14	0.07	0.08	0.13	0.09
Fatalities.....	0.08	0.09	0.07	0.082	0.056	0.068
Severity rating.....	669.6	727.7	617.6	650.4	541.1	586.9

year to year in number of accidents as well as days lost. The plants in this group are those that have given accident prevention work the consideration it deserves, and they have been repaid handsomely for their efforts. The second 25 per cent of the plants have made nearly as much progress in point of reduction; the first two groups forming 50 per cent of all of the plants carrying the load insofar as their continued reduction permits us to show a similar reduction in the total yearly figures. The third group is more or less at a standstill. The fourth group is the one that causes our real trouble. The extremely poor showing by many plants in the last group is more deplorable because in that we have many up-to-date plants, from a manufacturing standpoint, with mechanical hazards much less than is present at several of the plants in the better group.

In addition to the figures shown above, which are a study of the industry as a whole, we find that results obtained by those companies doing real, active safety work are startling and beyond expectation. Ten years ago we thought it impossible to cut down lost time accidents to 50 days or less per 100,000 man-hours worked. To say that safety work would enable a cement plant to operate a month without a lost time accident seemed an idle dream. However, records show that 50 days was too high, and that we at that time did not have the faith we should have had in safety work.

The figures given above are the results of safety work of a cement company operating 15 plants. In 1919, 6211 days were lost and in 1924, 2757 days were lost. In six years the results are remarkable and prove beyond a doubt that the great waste of human life, due to accidents, can be cut down. The average days lost per 100,000 man-hours over a period of six years, 1919 to

1924, show the work accomplished by safety committees.

DAYS LOST PER 100,000 MAN-HOURS,
1919 TO 1924

1919.....	59.2
1920.....	55.4
1921.....	43.7
1922.....	25.7
1923.....	22.3
1924.....	18.8

The vice-president of this company in a speech made at the National Safety Congress in Buffalo, after careful study of accident statistics of his own company, made the following statements:

Safety work improves efficiency. Nothing has ever been introduced into cement plants which has touched the hearts and spirits of employes as has the interest of the management in their physical welfare.

In my opinion as an executive, safety work has become as necessary and essential to the successful operation of a cement plant as a boiler house or laboratory.

The president of another cement company, who has done active safety work, made the following statement as to what he thought of the work in the cement industry:

There is no branch of Association work of greater import or value to the industry than that of your Bureau of Accident Prevention, and I congratulate you upon the growing interest of members in it.

Judge Gary of the Steel Corporation says: "Accident prevention is not only good morals and good ethics but also good business." In a letter to all the subsidiary companies of the Steel Corporation, Judge Gary also said: "Much can be done by designing new construction and machinery with all practical safeguards. Nothing which will add to the protection of the workmen should be neglected. The safety and welfare of workmen is the greatest concern."

Accident prevention is absolutely an essential part of the industrial program and production without safety is inefficient. A continuous accident prevention program carried out with the backing of the management means lower compensation insurance costs. It means conservation of man power; increased production and decreased labor turnover; reduction in material spoilage and improved plant morale.

Would any of us in the cement industry to-day use the old burr stone for grinding or the old dome kiln to burn clinker? No! Then why should any live, wide-awake concern neglect to do everything in its power to decrease accidents, which are a costly part of production expense. Accident prevention work is just as much a part of general efficiency as the use of proper manufacturing machinery. However, I am very glad to say that the great majority of the cement companies to-day are taking note of this most important part of cement manufacture. Those companies which are putting safety on the same plane with production are *getting both*.

HOW SAFETY WORK IS ACCOMPLISHED

Just how can this work be carried out is the question which enters the minds of those who have never done any accident prevention work. In the years gone by, the executives of different manufacturing concerns knew personally and intimately their superintendents and foremen and many of their employees. Business conditions are entirely changed to-day and the executive is kept busy in his office handling the business end and does not have an opportunity of associating with his men. The big corporation with many plants scattered throughout the country makes it impossible for the executives to visit the plants excepting on rare occasions, and that work must

be delegated to some one. In these days it is the department of safety that is handling many of the problems, not only of safety, but fire protection and fire prevention and industrial relations. To-day the foremen and safety committees are recognized as the backbone of the operating department.

In the early stages of safety work, before the days of safety codes and compensation laws, most of the work was done upon the orders of an insurance or factory inspector. There were no state standards. The guards that were ordered to be used were the best known at that time. However, to-day, many of them have been put aside and new standards are now in existence.

The whole success or failure of accident prevention work, the functioning of safety committees and the attitude of the foremen, depend entirely upon the executives of a company. The organization, from the president down, that realizes the value of safety and backs up the safety department and plant superintendents, *can expect results*. However, where indifference is manifested by those in authority, *no results can be expected or obtained*.

In making a study of the results obtained by those companies which have been successful in their safety work, we find that they have been successful because of the backing of the management and the careful and thorough work of the safety committees. Most of the successful plants have been well guarded, which perhaps relieves us of 20 per cent of the work in accident prevention; the balance is due entirely to the work of the safety committees. We find a great many of these committees are composed of foremen, for the different companies realize that they are the key-men and the ones who must be thoroughly educated to believe in accident prevention work, for if they do not, results will not be

obtained either in their own department or in the plant as a whole, for their attitude is reflected in the work of the men. The safety committee and the foremen must believe in accident prevention work just as they believe in anything else that prevents waste and increases efficiency in each department.

The duties of the safety committee were outlined as early as 1917 and a great many of the successful plants are following more or less along this organization.

The General Safety Committee has been divided and covers a large field of activities—the Inspection Committee, composed of two or more members, making a semi-monthly inspection of the plant and studying the accident hazards, lighting, items of maintenance and general housekeeping; the Fire Committee, making a semi-monthly inspection of fire hazards and all fire equipment; the First Aid and Sanitary Committee, having charge of first aid, hospitals and all medical supplies and making a thorough inspection of the sanitary conditions of the plant and

all company dwellings; the Publicity and Educational Committee, keeping the Bulletin Boards clean and attractive, instructing the men about the plant and working out a monthly program for the meeting; the Accident Investigation Committee, making an investigation of all serious accidents, reporting the cause of same and method of preventing similar accidents.

No hard and fast rule can be laid down as to the number of men on a committee, as we find each organization has its own ideas on this subject, but the general outline as given above has been followed.

All accidents are being reported to the companies, and the companies themselves report every lost-time accident to the Cement Association.

The yearly study of accidents as published in the *Accident Prevention Bulletin* of the Portland Cement Association is, without question, probably the most accurate of any industry in the country and it has proven most beneficial to the cement companies interested in accident prevention work.

Safety for Railroad Employees

By E. S. CHAPIN

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FROM the day of the first successful locomotive, safety in operation has been the prime consideration in railroad location, design, construction and maintenance. The constant striving for more powerful engines, larger cars, heavier rails, stronger bridges, shorter routes, lower grades, fewer curves, clearer signals and better station facilities has resulted in providing not only for the more rapid handling of passengers and freight, but also for increased safety while in transit.

The stories of the development of the air brake, automatic coupler, steel car, block signals, interlocking switch control, steel rail, steel wheel and many other well-known elements of modern railroad equipment would each provide material for an interesting treatise, but need only be mentioned here as examples of safety devices upon which millions of dollars, years of painstaking research and careful thought by the highest type of engineering minds have been and are being continually expended.

But all the money invested in these improvements would have been wasted if it were not for the conscientious vigilance of the human beings using and directing them.

WHAT STANDARDIZATION HAS DONE

The Train Operating Rules of the American Railway Association, developed from the combined experience of practically all the roads of this country, are the basis of the rules adopted by all of the roads. This standardization in the most fundamen-

tal training of all employees is one of the most valuable aids in safe operation, particularly in territories frequently encountered wherein trains of several roads use joint track facilities.

Many of these rules, such as those relating to train orders, flagging, display of train signals, observance of track signals, sounding of whistle signals, etc., are familiar examples of the recognition accorded to safety throughout the Code.

Lest anything were overlooked, one appears as follows:

In all cases not covered by instructions, take no chances, but follow the safe course.

How carefully these rules have been drawn and how well they are observed is attested by the infrequency with which it has been found necessary to make changes in the Code and in the fact that train accidents due to failure to follow them, when considered in proportion to the thousands of trains operated daily throughout the land, are remarkably few. Out of 900,000-000 passengers carried in 1924, only eleven were killed in train collisions.

A large amount of credit is due the Master Car Builders' Association which was founded in 1867 with the view of standardizing the parts used in car construction, for they have always kept safety in view when fixing standards of this kind. They are now a part of the Mechanical Section of the American Railway Association. They have developed the automatic coupler to its present high state of efficiency and among other things have made stand-

ard rules for loading long and bulky material, such as steel girders, lumber, steel pipe, plate glass, etc., on open-top cars which have added to the safety of freight train operation.

Another branch of this Association is the Bureau of Explosives, which has done research work and drawn up rules for the safe handling of inflammable and explosive materials while in transit or storage on or near railroad property. The work of this Bureau was of the highest value to the nation during the Great War, and although shipments in time of peace are smaller, the disaster which might result from even one failure can better be imagined than described.

The interchanging of cars in service between roads brought about a dangerous condition due to the fact that the location of end and side ladders, sill steps, grab irons and brake steps varied widely, and men working in yards at night or even in daylight were liable to reach for a support where they were wont to find one on cars of their own road, only to encounter empty air on the car of some other road. The need for standardization in the location of these fixtures resulted in the passage of the Federal Safety Appliance Act of March 2, 1893, which requires uniform location and strength of the parts mentioned. Defects in any of these required appliances must be repaired at the first opportunity.

Since July 1, 1888, the Interstate Commerce Commission has required that all railway accidents causing death or disability of over one day of passengers, trespassers or licenses, or death or disability of over three days of employees, shall be reported on standard forms.

VALUE OF STATISTICS

One of the greatest aids in accident prevention work is a background of

statistical information as a basis for comparisons. These figures compiled from the reports submitted by the various roads are published quarterly and summarized annually, so that each road can mark its progress with relation to its own previous records or the concurrent performances of other roads. This has caused a healthy rivalry to arise among the roads to see which can make the most improvement, and those not among the leaders are searching for the reasons within their own circles and this introspection has not been unprofitable by any means.

The figures following quoted from the Interstate Commerce Commission Accident Bulletin show the accident record for fourteen years and indicate the increases and decreases during those years.

The following table shows the consistent improvement in the record of fatalities in proportion to the numbers of all employees, of trainmen, and of passengers carried. In the same period the number of employees in service increased from 700,000 to almost 2,000,000 in 1924, the number of freight tons carried one mile has increased 575 per cent, and there were 52 per cent fewer passengers killed in 1924 than in 1888, although the number of passengers carried one mile was 300 per cent greater.

The reduction in fatalities to trainmen has made it possible for the Brotherhood of Railroad Trainmen to reduce their premiums covering accident and death benefits to members, due to the improved experience from the insurance standpoint.

Thus far we have only considered safety for railroad employes as it has been included in the larger field of safety for passengers, freight and railroad property, since any equipment or rules which protect the trains and their burdens include the men operating them.

Year	PASSENGERS		EMPLOYEES		TRESPASSERS		AT RAILROAD HIGH- WAY CROSSINGS		TOTAL PERSONS	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
1924..	149	5,354	1,533	124,882	2,556	2,853	2,149	6,525	6,617	143,739
1923..	138	5,847	2,022	152,218	2,779	3,047	2,268	6,314	7,385	171,712
1922..	200	6,153	1,648	116,757	2,430	2,844	1,810	5,383	6,325	134,871
1921..	205	5,584	1,458	104,849	2,481	3,071	1,705	4,868	5,996	120,685
1920..	229	7,591	2,578	149,414	2,166	2,368	1,791	5,077	6,958	168,309
1919..	273	7,456	2,138	131,018	2,553	2,658	1,784	4,616	6,978	149,053
1918..	471	7,316	3,419	156,013	3,255	2,805	1,852	4,683	9,286	174,575
1917..	301	7,582	3,199	174,247	4,243	3,829	1,969	4,764	10,087	194,805
1916..	246	7,152	2,941	176,923	4,928	4,793	1,652	3,859	10,001	196,722
1915..	199	10,914	2,152	138,092	5,084	6,448	1,086	2,981	8,621	162,040
1914..	232	13,887	3,259	165,212	5,471	6,354	1,147	2,935	10,302	192,662
1913..	350	15,130	3,715	171,417	5,558	6,310	1,125	3,080	10,964	200,308
1912..	283	14,938	3,635	142,442	5,434	5,687	1,032	2,506	10,585	169,538
1911..	299	12,042	3,602	126,039	5,284	5,614	992	2,434	10,396	150,159

NOTE.—1911 to 1915 fiscal years, ending June 30th. Totals include "other persons" not itemized.

YEAR ENDING	NUMBER OF EMPLOYEES IN SERVICE PER EMPLOYEE KILLED	NUMBER OF TRAINMEN IN SERVICE PER TRAINMAN KILLED	NUMBER OF THOUSANDS OF PASSENGERS CARRIED PER PASSENGER KILLED
Dec. 31, 1924.....	1,164	483	6,314
Dec. 31, 1923.....	894	370	7,216
Dec. 31, 1922.....	1,003	424	4,881
Dec. 31, 1921.....	1,160	451	5,096
Dec. 31, 1920.....	839	288	5,673
June 30, 1915.....	735	317	4,954
June 30, 1909.....	576	205	3,524
June 30, 1906.....	387	124	2,223
June 30, 1899.....	420	155	2,189
June 30, 1889.....	357	117	1,523

SAFETY FIRST MOVEMENT

The "Safety First" movement, looking toward the protection of the lives and limbs of railroad employes through the enlistment of their own interest in the elimination of preventable accidents, had its inception during 1910 when several of the larger roads inaugurated safety committees among their men. One of the outstanding figures in this work was the late Ralph

C. Richards, of the Chicago and Northwestern Railway. The results soon showed that through this agency many men were reached and brought to a realization of their responsibility in the performance of their duties in a safe way, rather than in a manner which involved danger to themselves or others, and many minor physical conditions which might have caused painful injuries were brought to the at-

tention of the proper authorities and corrected. The fact that all suggestions to these committees were considered and the great majority found acceptable, indicates the degree of co-operation reached and that there was need for the work.

Other roads adopted similar plans and interchanged ideas and experiences individually until December, 1914, when the Steam Railroad Section of the National Safety Council was formed, wherein all member roads contributed their part to a more uniform practice in handling safety problems. The new section grew rapidly and so important did the work become in the next three years that, with the inauguration of Federal control of railroads during the World War, a special department of safety was organized by the Director General and all railroads required to establish safety departments under a specified plan, which included safety committees and a supervisor of safety. Membership in the Steam Railroad Section, National Safety Council, was authorized for all roads and many of them which then formed their first connection therewith are still members.

The increasing number of deaths due to automobiles colliding with trains at highway grade crossings caused great concern to railroad safety men and a committee of the Steam Railroad Section, N. S. C., was appointed to consider ways and means of preventing them.

The American Railway Association authorized the organization of a Safety Section in July, 1921, which was practically identical in membership with the Steam Railroad Section, N. S. C., and the first work was to plan for a "Careful Crossing Campaign" which was conducted from June 1 to September 30, 1922. The good results warranted the continuation of similar campaigns in each of the following years.

In 1923 there were 2268 persons killed at highway grade crossings and there were 15,092,177 automobiles registered.

In 1924 there were 2149 persons killed, a decrease of five and two-tenths per cent, while the automobile registration was 17,591,981, an increase of thirteen and nine-tenths per cent.

For statistical purposes the Interstate Commerce Commission classifies railroad employes under 146 occupational titles.

This is only one indication of the great variety of duties performed by them, which include almost every major trade and profession to some degree, so that it is doubtful whether there is any industry covering so many lines of work, with each having its own type of hazard. The public see more of the train, engine and station employes and often fail to realize the parts played by shop, yard, freight station, track maintenance, executive and clerical forces.

GENERAL SAFETY MEASURES

In each class are men engaged in work which involves the same hazards as would confront a man in his occupation if working in an industrial establishment, and added thereto is often the hazard arising from direct contact with railroad operations—the movement of cars, engines and trains.

The average large railroad to-day has its own shops for car and locomotive repairs including machine, boiler, blacksmith, foundry, pipe, paint, wood-working, upholstering, tool-making, airbrake, car erecting, locomotive erecting, engine house, power plant, and electrical repair departments. Some have their own chemical and physical testing laboratories where any article used in railroad operation from drinking water to a locomotive under steam can be tested and its suitability to the requirements of the road be determined.

Forests, wood-preserving plants, wharves, coal and ore docks, grain elevators, office buildings, hotels and restaurants are just a few of the widely diversified places in which railroad employes may be found.

In each occupation there are certain hazards which are common to men in similar lines of work in any industry, such as the operation of a rip saw in a woodworking shop, handling molten metal in a foundry, climbing a wire pole, or the use of machine tools in shop operations.

The same safety measures are applicable to railroad employes that have been found efficient under like conditions in the other industries, such as the installation of spreaders and guards on saws, the use of goggles and asbestos leggings in foundries, keeping linemen's spurs sharp and life belts sound, or the guarding of belts and pulleys in the machine shop. Hazards of this class need not be considered further in this article. There are other hazards which are peculiar to the railroad industry and measures to overcome them are listed below:

SPECIFIC SAFETY MEASURES

Employes should not walk on or across tracks except in performance of duty; then face toward approaching current of traffic, keeping sharp lookout in both directions and clear of all tracks which are obscured by steam or smoke from passing trains.

Track gangs should be protected by a flag man on each exposed side, and should clear all tracks on approach of trains over the track on which they are working. They should all clear on the same side, if possible, so that all can be under the observation of the foreman. When clearing tracks all tools should be laid so that they cannot be struck by passing cars or engines.

Men should never go between standing cars on tracks unless it is known that they are not to be moved. No one should ever crawl under a standing train. When making necessary repairs to cars or engines on tracks

a blue flag or blue lantern signal must be placed between the last car on track and clearance point at entrance switches, on both ends if necessary.

Trainmen should never go between closely approaching cars to adjust couplers, or attempt to line up coupler heads by kicking at them, but signal with hand or lantern for cars to be stopped and see that they are stopped before making adjustments. After couplers are lined up they should step out and signal for the movement.

Yard tracks should be kept clear of all obstructions which might cause stumbling or slipping, such as broken couplers, lumps of coal, old ties, loose boards, etc.

Heel blocks should be kept in place on all yard switches.

Bridges or culverts should be used to cross tracks wherever available. Their very presence warns that any other course is dangerous.

Men cleaning snow from switches should be especially watchful since their ears are usually muffled and engineers approaching points where snow shovelers may be at work should be particularly careful to sound the whistle.

Employes should not attempt to board or ride upon the sides or tops of cars or engines moving into doorways, station sheds, warehouses, or tunnels where they may be caught by close obstructions. "Head tappers" are provided to warn of approaching close overhead clearance points and should be carefully maintained to insure their effectiveness. No one should be permitted to ride on tops of cars in territory where there are overhead electric power wires within nine feet of the surface on which they are standing, to make sure that they will not swing a lantern against the wire.

Boarding an approaching locomotive by stepping from in front of it onto the leading footboard should be prohibited and riding on the leading footboard is dangerous. Both of these can be stopped if the engineers are ordered not to move their engines with anyone on the leading footboard.

Air brakes should not be applied on standing cars or engines without first making sure that no one will be caught by the movement of the brakes.

Injectors should not be operated on standing engines until the man in the cab is sure that no one is under the engine where he might be scalded by steam or hot water escaping from the overflow pipe.

No attempt should be made to tighten boiler wash-out plugs or fittings while there is steam or hot water under pressure in the boiler which would be released if the fitting should break or come loose.

Boiler blow-off valves should only be opened when all workmen have been removed from under the engine, and then the man opening the valve should stand on the floor or ground alongside the engine where the escaping hot water cannot strike him.

Valve reverse mechanism should not be operated unless the man in charge knows that no one will be caught by the movement thereof.

When making repairs which require the disconnecting of main crossheads on locomotives under steam pressure, equipped with valve rigging on the outside of the engine frames, the main valves should be disconnected or blocked so that they cannot be moved, or provision made for allowing steam entering the valve chambers to escape freely and directly to the outside air, so that no movement of the valve mechanism can cause steam from the boiler to enter the cylinders and move the pistons.

When walking about yards, engine-houses or shops, men should walk around rather than through any cloud of escaping steam which obscures their pathway.

Wreck and work train derricks, self-propelled yard cranes, etc., should never be swung so that they would be struck by trains passing on adjacent tracks until all such tracks have been fully protected by flagmen or fixed signals.

When applying hand brakes with the use of a brake club the strain on the latter should be toward the car rather than away

from it, so that in case of the chain kinking or failing the brakeman will not fall from the car. Brake clubs should be made from sound, straight grained wood, and replaced before they are badly worn.

Tools on locomotives should never be allowed to project beyond the sides, nor placed where they might fall off.

Freight car doors or coke racks which have become loose so that they sway outward must be secured or removed and placed inside car.

Coal piles on tenders or coal cars must be properly trimmed when loading to prevent lumps falling off.

No open flame or ordinary hand lantern is safe to use around a wreck involving gasoline or explosives. Electric flashlights should be carried for these emergencies.

Wreck crews working in tunnels should have at least two oxygen breathing helmets and an adequate supply of "all-service" gas masks.

Deep water ash pits should be railed or covered with screens to prevent men from stepping or falling into them.

Shallow water pits should be designated by signs well lighted at night.

No one should ride on cars or engines with any portion of the body projecting into inter-track space, where it might be struck by track fences, mail cranes or passing trains.

While some of these precautions may seem trivial, every one of them has been shown to be necessary through the hard lessons of experience. That the future will see a still further reduction in accidents to railroad employes cannot be doubted when we look back on the past record and realize the high ideals of all railroad managers and employes in making absolute safety their goal.

Safety in Building Construction

By C. H. ALMSTEAD

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ABOUT ten years ago very little organized effort in accident prevention work was carried on by the construction or building industry. Where serious or fatal accidents occurred, the superintendent of construction was severely reprimanded and in a few instances steps were taken to prevent a reoccurrence of similar accidents, but there was no special systematic plan.

ACCIDENT PREVENTION MEASURES

During 1917 a small group of general contractors and others interested in the construction industry, located in various parts of the country, realized that the building industry was one of the most hazardous to life and limb of any of the existing industries, so they formed the Construction Section of the National Safety Council with the principal idea of organizing their efforts to concentrate on the principal hazards in the industry. This presented a somewhat complicated problem, due to the fact that the industry was not operating in a fixed location like industrial or manufacturing plants. Building operations were widely scattered and where a tentative accident prevention program was built up on a construction operation in a certain locality, it was wiped out as soon as the project was completed and the various building tradesmen released. The general contractor or builder then started another project in a different locality and consequently had to begin his accident prevention work all over again.

METHODS OF PROCEDURE

In general, accidents are prevented in two ways: by the installation of

mechanical safeguards and by the exercise of caution on the part of the workmen. The first requires the education of the employer in building the proper mechanical safeguards and the second means the education of the workmen as well as the foremen and employers along the broad lines of safety first. An employee cannot be expected to give the needed attention to the safety of himself and his fellow workers if his employer does not first show that he is interested in preventing accidents. This interest can be best manifested by the installation of mechanical safeguards on equipment and at dangerous locations on the work and by the sincere attitude of the employer in his attempt to educate the workmen.

Both of these methods are pretty generally understood throughout the industry at this time and membership in the National Safety Council gives an excellent opportunity for the interchange of ideas on the subject. A result of the educational program is that in a good many cases manufacturers of construction equipment safeguard all dangerous parts of their apparatus before it leaves the factory and a careful superintendent will place guards on the machines at the jobs if they are not so protected when received.

EDUCATIONAL METHODS

The Construction Section of the National Safety Council then organized their efforts at various meetings and conventions in open discussion as to the best ways to educate workmen in accident prevention and some of the solutions evolved that one of the best mediums of education was the safety bulletin board. Some incorporated a fixed safety program for each operation;

first, furnishing the operation with a first-aid kit, then constructing a safety bulletin board and supplying the operation with safety slogans and safety bulletins.

Most of the bulletins used on construction operations were and are at present obtained from the National Safety Council. Material for these bulletins was furnished by various contractors who were members of the section. Others were obtained from various insurance carriers. Safety warning signs were also placed on a good many operations and usually displayed upon temporary elevators, hoisting apparatus and at other points where there was any likelihood of accidents occurring. These slogans usually carried a warning such as "Safety First—Be Careful Always." At the inception of a construction operation a good many contractors held their superintendent responsible for the safety of the men, pointing out by correspondence and personal contact the danger of riding on material hoists, the danger in not wearing safety goggles on hazardous chipping work or any other dangers on the job where serious accidents were likely to occur.

Some general contractors found that where a building operation covered a large area and it was difficult for the superintendent to cover the complete job from a safety standpoint, it was advantageous to organize such an operation on a "safety basis" under a systematic plan, the superintendent being regarded as the head of the safety organization, having under him a safety committee consisting of three foremen, one of the three being designated as permanent chairman, the other two holding office for a period of four weeks as active committeemen. Every two weeks one man retired and the committee selected another from among their fellow-foremen to serve. Thus,

the job was getting the benefit of the experience of every foreman on the job. The committee inspected the job once a week and items requiring attention from a safety standpoint were taken up with the foreman directly in charge of the work in question. Every two weeks a safety committee meeting of foremen was called by the superintendent. Inspection reports were read and a summary report also read giving the causes of all accidents that occurred during the previous two weeks. Then followed a brief discussion relative to proper methods of reducing the accidents.

In addition to accomplishing its purpose from a safety standpoint, the plan helped to educate the various foremen on safety matters and also maintained a spirit of co-operation on the job.

Where contractors inaugurated this plan on large operations, accidents were materially reduced.

To further educate the employe on accident prevention, some builders conducted a "No-Accident-Month Campaign" with success. Others who were operating chiefly in one section or had building operations in close proximity held "smoker" meetings for their superintendents and foremen. These meetings were usually held in the evening and a good deal accomplished by general discussion and the interchange of ideas, which resulted in more harmonious co-operation in accident prevention on construction work.

The following example is typical of the beneficial results obtained by organized efforts in educating the worker. During 1922 a superintendent of construction, in charge of a heavy construction operation in the South, made a statement that it was practically impossible to get workmen to wear safety goggles on hazardous chipping work without threatening to

dismiss them. The same superintendent during 1925 made the following statement:

Much of the work has been drilling and cutting concrete and in places where both the calcine dust from roasted ore and dust from the concrete has been very bad, practically all the organization, including foremen, have been more than willing to wear goggles.

There are many similar examples that could be cited illustrating improved conditions and the above are only some of the educational methods used by the general builders which show an advanced step by the industry as compared with the lax methods existing previously.

VALUE OF ACCIDENT STATISTICS

During 1921 the Statistical Standardization Committee of the Construction Section of the National Safety Council (this committee consisted of representatives of general builders) realized that accident prevention work was seriously handicapped by lack of adequate accident statistics. Further, that with a list of causes the industry would have a guide for accident prevention measures, and in consequence the following list of causes was prepared and adopted by the Section as a standard list:

- (1) MACHINERY AND EQUIPMENT
 - (a) Boilers and steam pressure apparatus
 - (b) Vehicles
 - (c) Hoisting apparatus
 - (d) All other
- (2) EXPLOSIVES, ELECTRICITY, FIRES AND HOT SUBSTANCES
 - (a) Explosives
 - (b) Electricity
 - (c) Fires
 - (d) Hot substances
- (3) POISONOUS AND CORROSIVE SUBSTANCES
- (4) FALLS OF PERSONS
 - (a) From scaffold and ladders

- (b) From all other elevations
 - (c) Into excavations, floor openings, etc.
 - (d) On level
- (5) FALLING OBJECTS (not being handled by injured)
 - (a) From elevations
 - (b) Cave-ins
 - (c) Collapses
 - (d) All other
- (6) HANDLING OF MATERIALS AND OBJECTS
 - (a) Wheelbarrows, concrete buggies and similar hand carts
 - (b) All other
- (7) USING HAND TOOLS
- (8) STEPPING ON AND STRIKING AGAINST OBJECTS
 - (a) Nails
 - (b) All other
- (9) MISCELLANEOUS

Before adopting the above list the committee carefully checked it with the standards in use by the best known authorities engaged in the compilation of accident statistics. Tabulations obtained under this list can be compared with records by other well-known accident statistics gathering bodies, such as the U. S. Bureau of Labor Statistics, the National Workmen's Compensation Service Bureau, the International Association of Industrial Boards and Commissions and the Headquarters Staff of the National Safety Council. This list is flexible in that any individual construction company encountering special types of accidents can insert additional appropriate sub-classifications under the main heading, without in any way disturbing the framework of the standard list.

At the time this classification was adopted it was decided that in order to get the best results some individual in the home office of the contracting company should classify the accidents according to the above causes. This party should also make it a point to see that accident reports come in from the various operations sufficiently clear so

that an intelligent classification can be made. While it is true that since the adoption of this classification only a small number of general contractors are reporting their statistics to the National Safety Council, the industry as a whole has organized its efforts and has made a fair start.

With adequate statistics, executives can readily ascertain the causes of accidents which are occurring, enabling them to grasp clearly the waste and loss of efficiency which accidents represent. It has been conceded by all industries that only when the facts regarding accidents are presented in a more or less exact concise form, instead of in a vague general way, can a busy executive be reasonably expected to realize fully the importance of the accident problem and its significant bearing upon the well-being of his employees and the productiveness of his business.

In spite of the fact that since the adoption of the classification only a small number of builders are reporting statistics, the industry as a whole has been able to determine the causes from which the greatest frequency and severity of accidents are occurring and due to this effective method of classifying accidents, it has been found that the greatest frequency of accidents is from "Handling of Material and Objects," and the greatest severity from "Falls of Persons from Scaffolds and Ladders."

The Construction Section statistics, as published by the National Safety Council for 1924, showed a much lower severity rate over the years 1923 and 1922. Two general builders, one of which employed an average of over 400 men, finished the year without a lost-time accident. There were approximately 23 general contractors who reported statistics for the year 1924 and the number of man-hours worked by these contractors numbered 19,009,681 and the average number of

employees totaled 15,681. Surely, this is an indication of the results obtained by organized efforts. It indicates an advancement by the industry in accident prevention and shows that excellent prevention work is being carried on and that accidents in the construction industry can be prevented.

In order to stimulate more interest among general contractors, the Statistical Committee of the Construction Section of the National Safety Council in the early part of 1925 prepared an accident summary report form, so that all the members reporting would have their accident records on a standard basis and the Section would be better enabled to concentrate their combined efforts in reducing or eliminating the principal causes of accidents in the industry.

SAFE PRACTICES—CODES

In some parts of the country general contractors have worked up and are using safe practice rules on their various operations and where such practices have been enforced decided improvements have been noticed from a safety standpoint.

Some states have issued specific requirements for building and construction work and contractors who have followed these requirements have shown improvements on their various operations. While it is very difficult in a number of instances to get some contractors to incorporate safety on their operations and to get some to do what is only absolutely necessary to comply with safe practices and specific requirements, there is also the better class of contractors who through organized effort are doing their utmost to promote safety activities in the industry; and in many instances they incorporate more stringent safety measures than called for by any existing safe practice rules or requirements, in-

dicating an improvement over conditions existing some eight or ten years ago.

THE REALIZATION OF ECONOMY

During the past few years executives have begun to realize the business value of safety work and some general contractors have succeeded in obtaining a reduction in their experience rating in some states as high as 30 or 40 per cent. This is an advanced step when we take for example an estimated payroll of \$100,000 at an average manual rate of 5 per cent, resulting in a manual-rate premium of \$5000, on which a 20 per cent experience credit rating reduction would save \$1000. As a matter of fact most contractors pay a manual rate averaging nearer to 7 per cent than 5 per cent.

Aside from a humanitarian standpoint, contractors are beginning to realize more and more the efficiency of construction forces working under safe conditions and where actual comparisons were made it was found that the builder who had adopted precautionary measures obtained more efficient results than his competitor not employing safe methods.

One direct indication that organized efforts are producing results is indicated by the growth of the Construction Section of the National Safety Council, which not only has members in the United States and Canada, but can also boast of a member in Japan who is carrying on organized safety work. At the Cleveland convention of this council from September 28 to October 2, 1925, there were approximately 150 representatives of various contracting companies, which is perhaps the largest number that were ever present at a convention of this kind. A number of principal executives of various construction companies were also present and showed a very keen interest in the subject and the Section succeeded in re-electing as their chairman the chief executive of a prominent general contracting company in the Middle West, who during the past year spent much of his valuable time in this important work and who has seen the merits of accident prevention in such a way that he is willing to head up the Section for another year. With this organized effort the familiar slogan "A Life for Every Story" is rapidly fading into oblivion.

Safety in the Automobile Industry

By R. F. THALNER

Safety Director, Buick Motor Company, Flint, Michigan

SPRINGING from a very small organization about a quarter of a century ago to one of the leading industries of the world is the progress which has been made by the automobile industry. From a ratio of one car to every 18,000 people in 1898 to one car to every seven people in 1925 is the marvelous advance which has been made by this seemingly new organization. There were approximately 17,000,000 motor cars in use in this country at the close of 1924 with a prospect for the manufacture of 4,200,000 for the year 1925. These rapid strides in production have probably placed automobile manufacturing in the unique position of being the most rapidly growing industry of all time.

With this unusual growth has come development and expansion of factories and equipment from the old small plant, in which every man was a skilled mechanic and completed one particular piece, to the present large sized multiple production manufacturing units in which skilled mechanics are few but operators or semi-skilled mechanics are in the majority. Along with this rapid expansion of buildings and equipment there was the concurrent increase of the working force by the thousands, and these workers (not all skilled mechanics) were drawn to the automobile plants from all walks of life by the lure of good wages. Thus we have an assemblage of workmen or operators of machines who probably were formerly engaged in such occupations as barbering, clerking, farming, road building, carpentering, laboring, etc.

With this rapid influx of untrained

and unskilled men, brought in contact with machines and equipment to which they had never been accustomed, a new problem presented itself to the automobile industry in general, and that was the one of preventing accidents. In the early years of the industry shops were small and mechanics were plentiful and skilled at their work. Men who applied for work in automobile shops knew what conditions they had to contend with. The result was that, although machines probably were not properly guarded, the man who ran them understood all of their good and bad points, which was a big factor in keeping him from injury. True, there were men, and skilled men too, who were injured in those times, but of course a good many of these injuries could be attributed to the unsafe construction of the machine.

INCREASE IN ACCIDENT HAZARDS

The automobile then passed from the experimental stage to that of being a commodity which provided pleasure, consequently those people who could afford this luxury created a demand which warranted the manufacture of the article on a higher production basis. Systems of inspection tending toward standardization of all parts were set up so that one man, instead of completing a certain job alone, became an operator and completed one or more processes in the manufacture of that particular piece. This necessitated an increased amount of help and, inasmuch as skilled help was not required, untrained men were

brought into the organization and trained into the methods of performing their particular operations. There remained, however, the hazard of the unguarded machine and unsafe equipment because, due to the rapid expansion, these conditions were not given proper consideration or thought with respect to the new and inexperienced men who would be called upon to handle them.

The automobile is now passing from the pleasure state to that of being a present day commercial necessity. The truck is displacing the horse for hauling purposes, the bus is coming into its own for the transportation of passengers, and the individual car, in addition to being a source of pleasure to the family on Sundays and holidays, has found its place in the everyday life of business. The increased use of the automobile in the daily life of the people has of course caused an exceedingly heavy production, with the result that the operations in the shop have become more segregated and confining. Men are now doing one operation where they formerly performed more than one, and on that operation are rated as semi-skilled men.

The typical steps are thus depicted from a production viewpoint in the automobile industry. In the early stages safety or accident prevention was probably unknown; in the second stage, when insurance companies were assuming the risk of these industries, some safety work was done through these organizations, but it was not effective, due to the fact that they were not considered a unit of the organization and therefore could not, with authority, put any plans into operation. The result was that the only possible way to assume a risk was to be sure that it was not too great, and if a bad experience was encountered this year

the premium for the next year was increased. The constant increase in accidents was noticed by managers both from the humanitarian and economic standpoint. To have a man injured in a plant not only meant that he must be paid compensation but there was the additional charge on society of the maintenance of this man's family in case of death and the man also in case of total disability.

In addition, breaking in a new man, with the attendant scrap and low production which goes with that process, was unprofitable, so it was not long before safety departments were organized and put into operation as an integral unit of the plant in an endeavor to eliminate this needless waste. Most of these have been effective, and the result has been due to the fact that the department generally has received recognition from the top down. Where this is the case satisfactory results have been obtained and economically employer and employe have benefited.

ACCIDENT PREVENTION WORK

The writer is not certain as to where the first safety organization was created in the industry or at what time, but from information at hand it is known that safety work was started in 1914 in some plants and possibly earlier than that in other factories of which no record is available. At the present time every automobile company of importance has a fully developed safety department, whose sole function is the prevention of unnecessary accidents and the elimination of needless waste. Consequently, in putting one particular person in charge of this work it becomes his responsibility to see that plans are carried out which will benefit both employe and employer.

Safety work in any automobile plant requires a knowledge of many diversified processes of manufacture

because the modern automobile factory usually has, as a part of its makeup, such plants as gray iron and aluminum foundries, drop forge, sheet metal stamping, woodworking shops, machine shops assembly, stock room, loading docks, and a certain amount of construction work which all have their inherent hazards. Thus to successfully carry on work, to combat or curb industrial hazards, a thorough knowledge must be had by the personnel of any safety organization so that it can converse intelligently with the executives and workers of these various plants.

There are two main avenues through which accident prevention work should be carried on in any plant. First, there are accidents resulting from machinery and equipment which can be decreased or eliminated by a proper design of the machine and equipment, by redesigning the same or, as a last resort, by providing safeguards. Second, there are accidents which can be prevented by education, which must be carried on by keeping incessantly before the employe propaganda in one form or another relating to methods to be used for the prevention of unnecessary accidents.

Along the line of engineering revision and mechanical guarding many things have been done, from the application of a small guard to the complete redesigning of a machine, and in some instances changing an operation from one machine to that of an entirely different type. To begin with, all gears which are located so that men are likely to come in contact with them should be covered. Slow moving gears should not be considered less harmful than rapidly revolving ones because it is the slowness of them that usually lures. Belts in dangerous positions should be covered so that men cannot become entangled in, or struck by them,

if they should break. Many hazards can be eliminated by proper design.

MAKING DIE CONSTRUCTION SAFE

Among some of the most notable processes and revolutionary changes in the automobile industry are those which have taken place in the sheet metal stamping plants which were heretofore considered very hazardous, due to the fact that it was necessary for men to place the stock between the dies or at the point of operation with their hands. The mechanical process of placing the stock, tripping the press and removing this stock became so easy of operation on intense production schedules that little thought was given to the operation after it had been mastered. As the habit grew upon the operator and less thought was required for the operation, there came a time when for an instant the hand and foot failed to synchronize in their motions with the disastrous result that the press was tripped while the hand was either putting in or taking out the stock.

The first step to guard against this type of accident was a guard so devised that when the press was tripped a mechanical contrivance would automatically push the hand away from the die. As a first step this was a worthy one and those guards have saved many employes from serious injury. Devices whereby both hands were used in tripping the press after the stock was placed were also used with satisfactory results. But as time went on and we progressed in our methods, steps were taken to eliminate punch press accidents occurring at the point of operation by building a die which would make it unnecessary for the operator to place his hands between the dies. This is being done at the present time with a great deal of success in a number of large automobile plants.

Mr. August Kaems, of the Simmons Company in Kenosha, Wisconsin, probably was the pioneer along this line, and after a demonstration by him at a meeting of the Automotive Section of the National Safety Council, at Milwaukee in 1920, other safety men who had power press departments took up the idea with the result that at the present time safe die construction is making much progress and has been responsible for taking much of the hazard out of the sheet metal plant. If the die is large and cannot be made safe by design, tongs for feeding and taking out stock, or safeguards can be used.

OTHER GENERAL IMPROVEMENTS

The use of protective clothing, such as foundry shoes, leggings and goggles in factories where men work around molten metal has been directly responsible for the reduction in serious metal burns. The idea of wearing protective clothing of this kind was at first difficult to sell to the employe, but after having had little experiences of their own as to the protection that the clothing offered, the rule for wearing was more readily complied with. Equipment for handling molten metal must be in first-class shape at all times and conveyors and special machinery should be provided with guards.

In woodworking shops the displacement of square head joiner and shaper cutters with round heads and the use of guards on saws, joiners, gainers and shapers wherever possible has caused a material decrease in woodworking accidents. The shaper, as used in an automobile plant, is a very difficult piece of machinery to guard except for the usual guarding of belts and pulleys. The point of operation, or the head, is the part of the machine that does the damage and it is also the part of the machine which is very

hard to cover up because the cutting edge must be exposed to the work. However, by the use of forms to hold the work, with handles away from the cutter that require that the operator keep his hands on them, this type of accident has also been placed in the discard.

The drop-forge plants are not without hazards due to the fact that men are handling white hot metal and work on machines which are fed by high pressure steam lines subject to vibration. It is very necessary that the equipment be kept in the best of condition and that the stock be handled in as careful a manner as possible. It presents quite a different problem than that of handling cold stock. There is also an eye hazard in the forge shop and the use of goggles to protect the eyes from flying pieces of steel has come to be required as a necessary part of a man's working equipment.

The machine shop in general presents many hazards, such as open belts, gears, revolving shafts, rapidly moving transmission lines and an intricate amount of specialized machinery with special tools, jigs, fixtures and cutters. A great deal of guarding can be done, such as sanely covering up belts, inclosing all gears and removing or covering up protruding parts on revolving shafts which might engage the clothing of an operator. A great deal of work can be done on safe construction of jigs and fixtures used for holding the work, because many times the process of making a jig or fixture safe has also caused a corresponding increase in production as well as keeping the men free from injury and on the job at all times.

Car loading, although not seemingly dangerous, presents hazards which must be reckoned with. Eye hazards caused by flying nails in anchoring automobiles in cars can be overcome

by the use of a specially constructed hammer known as the Bulls-Eye Safety Hammer, which consists of nothing more than an ordinary hammer with annular grooves cut at intervals on the face. This hammer prevents a nail from flying when struck a glancing blow.

THINKING SAFETY

In carrying out educational programs the most general method used is the bulletin which portrays a lesson in accident prevention by use of a picture which shows the proper way of doing a certain operation.

Another method in general use consists of publishing articles in the weekly or monthly paper of that particular shop, showing things which have happened and conditions which will in the future cause accidents. Much interesting material can be brought to the employees in this manner and registered on their minds in a way that they would probably otherwise learn through sad experience.

Other methods have been used, such as posting signs around the plant, using short sayings on clock cards, causing competition between shops by allotting prizes, etc. All of this is done with the one end in view, that is, endeavoring to have the employee think in terms of safety so that anything he might anticipate doing will be done only after careful consideration has been given to the results of that action.

Without question the most important part of accident prevention work, from both the mechanical and educational standpoint, is that part which can be accomplished through the supervisory methods of the foreman. Upon his shoulders rests the responsibility of whether or not an accident prevention program can be the most successful, because inasmuch as he is responsible for production he should

also be responsible for "safe production."

Many remarkable reductions in accident severity and frequency have been made by various companies in safety work in past years but due to the limited space for this manuscript no figures will be quoted. Readers desiring detailed information along this line can obtain same by writing directly to the Safety Engineer in charge, to the National Safety Council or to the writer.

WHAT MANAGEMENT IS DOING

Expressions from leaders of the automotive industries will further tend to strengthen all that has been said regarding well organized accident prevention work and for that reason the following messages are cited:

H. H. Bassett, president and general manager of the Buick Motor Company, in the September, 1923, issue of the *National Safety News*, said:

Experience has thoroughly demonstrated that through proper organization, accidents in industry can be greatly reduced. Every employer is by duty bound to do everything in his power to safeguard the workmen. Hundreds of employees in the Buick factories have been saved from injury since the inception of a Safety Department. This has been of mutual benefit to both the employees and the company.

In 1914 the manager of the compensation department of the Ford Motor Company came to Henry Ford with a request for authorization to build a larger industrial hospital. No verbatim report of the conference was made, but it is related the conversation ran something like this:

Manager of compensation department:

We need a big hospital to care for our injured employees. We owe it to the men to take good care of them when they are hurt,

and besides it will be a good investment because proper hospital attention will enable injured men to get back to work quicker than they do under present conditions.

Mr. Ford:

No sir, we will not go into the hospital business. We will eliminate accidents instead. If we owe it to our men to care for them when they are hurt, we certainly owe it to them to do everything in our power to keep them from getting hurt; and if it would be a good investment for us to build a larger industrial hospital, it certainly will be a better investment for us to get rid of accidents. That's your job from now on. *Prevent accidents*, even if you have to redesign our machines or methods to do so.

A. R. Erskine, president of the Studebaker Corporation, said:

It is the fixed policy of the Studebaker Corporation to provide the best possible working conditions for its employees. This includes factory buildings of concrete and steel construction with adequate space, modern heating and ventilating systems, an abundance of light and pure drinking water, and fully protected with fire prevention and fire fighting apparatus.

Workmen are guarded against accidents from machinery by the best devices known, and educated in the care of their health and the protection of their bodies.

This policy is steadily reducing the number and seriousness of accidents, an objective in which both the employer and employe are alike vitally concerned.

W. Ledyard, vice-president of the Maxwell Motor Corporation, in charge of production, outlined the position

of the management in regard to the safety program:

The Maxwell Motor Corporation stands squarely behind this safety movement. We have not gone into this matter without giving it serious thought. We have carefully formulated our plans and we feel certain that we have entrusted the carrying out of these plans to the best men in our organization. The management of this corporation feels that accident prevention is good business, but beyond that, we feel a moral responsibility for the protection of every employe in our plants.

The foregoing statements of leaders in their respective communities tend to prove what real accomplishments can and have been made in organized prevention work.

The factories under the guidance of these men as well as many others have made remarkable reductions in accident severity and frequency rates during the time they have been engaged in this work. Many wonderful results have been accomplished which could not be mentioned in this article due to the limited amount of space. Through these results, which have proven beneficial to both employe and employer, the safety movement has found a fixed place in the automobile industry and the solution of its problems in the future along this line will tend to keep it foremost in the ranks of accident prevention work throughout the country, to the end that employe and employer will mutually benefit by the same from the humanitarian as well as the economic aspect.

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Safety in the Chemical Industry

By L. A. DE BLOIS

Manager, Safety and Compensation Division, E. I. duPont de Nemours & Company;
past President, National Safety Council

THERE exists no more fertile field for safety work than the chemical industry. While its accident record, so far as known, has not been conspicuously bad, there have occurred from time to time in various industries catastrophes of chemical origin, involving in the aggregate much loss of life and property damage. Many of these accidents were unquestionably due to the natural properties of the materials being handled or to hazards inherent in certain chemical processes—in other words, to conditions essentially peculiar to chemical work and likely to be met with in the chemical industry itself.

INHERENT ACCIDENT HAZARDS

It seems hardly necessary to point out that in the wide diversity of chemical processes there are encountered, in addition to the common industrial accident hazards, many dangerous materials such as acids, alkalies and other corrosive substances, as well as those which are by nature irritating, intoxicating, irrespirable or directly toxic. Hazardous conditions affecting the safety or health of employes may be due to the presence of vapors, gases or dusts or to the substance itself in solid, liquid or molten state. An acute fire hazard may be present or there may be danger from an explosion of dust clouds or of vapor or gases in admixture with air, or of the material itself either as a true explosive or when subject to rapid decomposition under confinement. Many of the newer chemical processes, moreover, necessitate the use of high electrical voltages or heavy currents, high temperatures or high pressures,

sometimes even exceeding 1000 pounds per square inch, and all these possess potential destructive power.

Contributing in no small way to the inherent hazards of the industry are other factors less obvious but equally difficult to control. The chemical industry is the youngest child of applied science and has not yet advanced beyond the stage of development to the point where standardization of method and process is entirely practicable. In fact, in many of its branches—for example, the dye industry—it is still in the experimental stages in which manufacture is peculiarly subject to sudden failures and to unexpected happenings. Indeed, the chemical engineer in designing new equipment or planning new processes is often seriously handicapped by absence of available information on the behavior of ingredients, products or even common structural materials under given process conditions and must depend to an unusual degree on his imagination and upon general deductions. The operating officials share to a great extent this same handicap. Under such conditions it is by no means surprising that serious injuries and even catastrophes take place. There is, besides, a natural dearth of men, both of the salaried and payroll class, experienced in chemical work. Of the latter class, it is often necessary to employ foreigners and a high rate of labor turnover caused by conditions not always within the employer's control militates against the creation of a safe establishment. All these factors add to the seriousness of the industry's accident prevention problem, although

it can be conjectured that some at least will be offset by the natural development which only time and experience can effect.

We have said that the chemical industry offers a fertile field for accident prevention work. This is not because its accident record has been conspicuously unsatisfactory but rather because conditions which are capable of causing accidents—using the term in its broadest sense—are particularly undesirable in a chemical plant. In such an establishment there are three factors of great economic importance, adverse variations in which are capable of seriously affecting not only the plant's operating efficiency but even the continuance of its existence as a successful commercial enterprise. Each of these factors is in turn adversely affected by accident occurrence. They are, briefly stated:

- (1) Conservation of materials.
- (2) Accuracy of chemical control.
- (3) Maintenance of equipment.

While many of the commoner chemical ingredients cost but a few cents per pound, others, as well as some of the chemical products manufactured from relatively cheap ingredients by a proc-

ess that is expensive to operate, have values reaching from a few dollars to \$50 per pound. Losses of such materials or products through explosion, fire, decomposition, leakage or escape of dust are not only commercially intolerable but are sometimes the direct cause of bodily injury or occupational disease and, through their influence on plant housekeeping and maintenance, are the indirect cause of accidents of other sorts. Conservation of materials is therefore of importance both from the commercial and from the humane standpoint.

Accuracy of chemical control demands knowledge, experience, intelligent supervision, high grade personnel, a trained and stable organization, good working conditions, suitable and reliable equipment, pure ingredients and many other requirements found only in an efficiently conducted establishment. Absence of accurate chemical control inevitably results in poor yields and occasionally in serious accidents which interrupt the routine of manufacture, curtail production, increase operating costs, and disturb the peace of mind of all employed. Even minor accidents may result in depreciation or damaging of plant equipment, in loss of materials

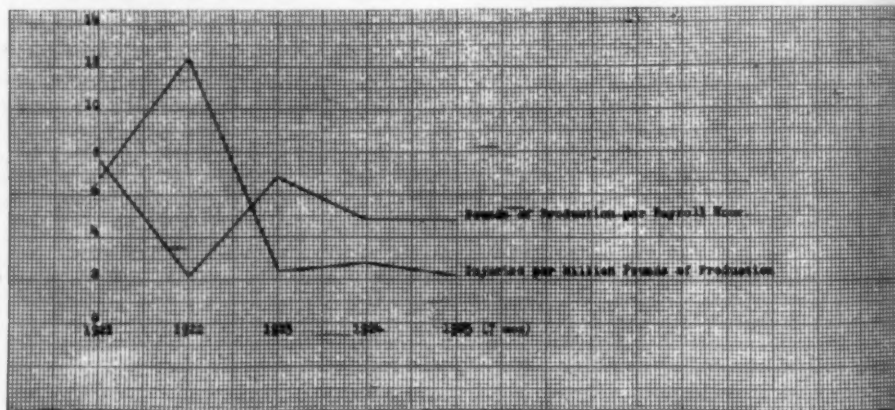


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or product, or in physical injury and, sometimes, death. In the chemical industry accurate control is indispensable.

Maintenance of equipment is important from the commercial viewpoint because of the high first cost of chemical equipment, its rapid depreciation under even normal conditions of use and the bearing that its condition has on chemical control and the prevention of avoidable process losses. Single pieces of equipment, such as autoclaves, may cost \$10,000 or more and the structure, foundation, piping and auxiliary appliances necessary for their operation, as much more. A single accident arising from faulty maintenance may not only wipe out the entire investment but entail physical injury and additional structural damage costing in excess of \$50,000. Aside from the high rate of obsolescence due to rapid developments in the art, there frequently exists an abnormally high rate of depreciation from natural wear, often accentuated by the action of the ingredients on the equipment or by the nature of the process itself. Depreciation of fifteen per cent per year in the value of chemical equipment is not unusual and individual autoclaves, retorts or other process containers may last but a year, even when given the best of care. Almost invariably the rate of depreciation is increased by

abnormalities in the process, in other words, by accidents. In some processes the rate of depreciation and the actual condition of the equipment is difficult to determine. If its deterioration progresses faster than expected or is increased by misuse or abuse, sudden and unexpected failure may result with consequent structural damage and loss of life. Careful inspection of equipment and adequate maintenance are therefore essential to satisfactory operation and both depend to a great extent upon the existence of an enlightened administrative policy and the presence of a capable and efficient executive and production organization.

ECONOMIC ADVANTAGES

The joint effect on production efficiency and accident occurrence of such important factors as cost of materials, chemical control and maintenance, and of the manufacturing conditions upon which they depend, will be readily understood by those familiar with plant operation. It is the *raison d'être* of the familiar statement, "a safe plant is an efficient plant." In Chart I have been reproduced curves showing the five-year record of a chemical plant with somewhat over 1500 payroll employees. It will be noted that the relation between production efficiency (expressed as pounds of production per

GROUP	NO. OF PLANTS	TOTAL NO. EMPLOYEES	NO. OF DEATHS	NO. OF ALL INJURIES	FREQUENCY RATE	SEVERITY RATE
Acid.....	2	241	0	54	76.2	9.03
Explosives.....	3	1804	2	22	5.1	2.81
Paint and Varnish	1	2561	3	39	6.3	3.18
Smelters and Copper Refiners.....	3	2744	3	232	27.2	2.90
Dyes.....	3	4064	4	194	24.9	4.74
By-Product Coke and Coal Tar.....	4	1625	0	161	36.4	1.00
Miscellaneous.....	14	6219	4	564	34.1	2.65
Total.....	30	19,258	16	1266	26.1	3.07

payroll-hour) and injury occurrence (expressed as number of injuries per 1,000,000 pounds of production) is reciprocal; in other words, as safety increases efficiency increases, and vice versa. This is precisely what we should expect to find since, in the last analysis, accident prevention is but one form of waste prevention and waste is the enemy of efficiency.

SAFETY PROGRESS

By carrying somewhat further the thought expressed in the preceding paragraph, we reach the conclusion that the most conspicuous accident reductions should be looked for in the records of the more efficient chemical plants and that the more progressive (and probably the larger) chemical manufacturing corporations should exhibit signs of real progress in effective safety work that might be lacking in the case of the less progressive (and generally smaller) concerns. This, the author believes, does express the condition of affairs at the present time and also sufficiently explains why the chemical industry as a whole, at least so far as available statistical information permits any conclusion, has as yet shown no conspicuous reduction in the frequency or severity of industrial injuries. That progress is being made in accident prevention within the chemical industry is assured, but that the rate of progress is sufficiently rapid to overtake the expansion of the industry itself is open to question. Safety as a principle has been accepted by the present-day executive and engineer, but safety as a practice is quite another matter and many able executives and engineers do not yet see it as a subject of primary importance, inextricably interwoven with production efficiency. Until they do so and make of it an executive function its advance will be faltering and slow.

The injury records furnished the National Safety Council by the individual members of its Chemical Section show improvement in injury severity at least for, while the frequency rate (number of injuries per million man-hours worked) increased from 24.6¹ in 1923 to 26.1² in 1924, the severity rate (number of days lost per thousand man-hours worked, weighted for permanent disability and death) decreased from 4.78¹ to 3.07,² the latter figures representing a 36 per cent reduction. This is an excellent record, but one must remember that the membership of these companies in the National Safety Council suggests that they are representative of the more advanced class rather than the average of the industry. The 1924 rates for the entire section are given on page 128.

These groups are in themselves too small to permit comparison for relative hazard; the total figures, however, are significant. Comparison with those of other industries will probably convince the reader that, in spite of inherent hazards, work on a chemical plant can be made comparatively safe. In explanation of this, Dr. C. L. Reese, former Chemical Director of the du Pont Company, President of the American Institute of Chemical Engineers and for years a close student of the chemical industry, is authority for the statement that where hazards are recognized extra precautions are taken to provide for the safety of the plant and its operatives. He states:

This is notably true in the explosives industry, the accident record of which compared with the records of many of the purely mechanical industries shows much lower loss of life, in spite of the spectacular character of the accident losses

¹ Mean rate for thirteen companies employing 7181 average employees.

² Mean rate for thirty companies employing 19,258 average employees.

—all of which goes to show that recognition of danger, once established, is met by the exercise of extraordinary precautions. This doubtless applies also to other branches of the chemical industry.

OUTSIDE AID

Through its Chemical Section the National Safety Council has made many valuable contributions to the accident prevention movement in the chemical field, which will be found in its published Proceedings, Safe Practice Pamphlets, Safety Bulletins, and Chemical Data Sheets. The recent report of its Benzol Poisoning Committee is an especially noteworthy contribution. The National Fire Protection Association in its own field has added much authoritative information to what was previously a scanty fund of knowledge. Among state agencies

contributing work of constructive value on the prevention of chemical injuries and occupational disease the departments of labor of New York, Ohio, Massachusetts, Wisconsin, and especially Pennsylvania and New Jersey should be mentioned. The U. S. Public Health Service, Bureau of Mines and Department of Labor have also done much to help the chemical manufacturer, as have also many national associations, too numerous to be here mentioned. Research, investigation and the collection, correlation and publication of actual experience in chemical safety and health is constantly going on and in time there will be built up a body of authoritative information of immense value to those chemical manufacturers who are earnest in their desire to maintain safe and healthful industrial establishments.

Safety in the Paper Industry

By WILLIAM JOHN PEACOCK

Chairman, Paper and Pulp Section, National Safety Council

SAFETY in the paper industry has been the informal business of many men during the last twenty years. Unfortunately the records were carried about, like Lincoln's post office, under the hats of individuals who never have felt constrained to put the facts on paper. The writer of this article, comparatively new to the paper safety field, sets down such general statements as are unquestionably within the facts, somewhat apprehensive of the opinion of pioneers whose memories might wish to add to the story.

INCEPTION

Printed records of safety efforts in the paper industry began with the formation of the Paper and Pulp Section of the National Safety Council at Philadelphia, in 1915. Safety activities of commendable sort had been carried on for years in several forward-looking mills, but prior to 1915 there were no organized efforts. To S. F. Shattuck, treasurer of the Kimberly-Clark Company, eminent for his success in industrial relations, goes the credit for yeoman service that started the present vital movement in the industry. He found backing in a few kindred souls, notably G. E. Williamson, of the Strathmore Paper Company, and R. B. Robertson, of the Champion Fibre Company, and a meeting was called in connection with the National Safety Congress with Mr. Robertson drafted as chairman. That gentleman, however, seems to have led a good-natured stampede for Shattuck, who was placed at the head of the new section.

Mr. Robertson was elected vice-chairman, and E. P. Gleason, of Nekoosa-Edwards Paper Company, secretary.

The meetings of the section were but thinly attended at first and the going was heavy. However, dynamic interest was forthcoming with other safety men who allied themselves with the new body. In fact, among the early few who gave their best to the section were representatives of paper mills who had helped to organize the National Safety Council some four years before they were ready to effect an organization of the "Paper Manufacturers' Sectional Meeting." The first meeting brought together thirty-one delegates, representing fifteen paper mills and as many friendly or allied concerns.

Under the leadership of Mr. Shattuck the new section found its stride during the first meeting. In fact, much of the prominence gained by the Paper and Pulp Section has been due to the vision and energy of this son of Yale whose own mills have striven back and forth amongst themselves for the larger rewards of safety, while other mills, many of them, were only beginning to catch the enthusiasm of the game.

The program of the first meeting of the section might be taken for advanced ground in 1925. "Safeguarding Machinery for Paper-Making"; "Hazards in Woodyards"; "Specific Dangers in Paper Plants"; "Safety Inspection Methods"; "The Relation of the Employment Department to Safety Problems," these subjects under the treatment of Gleason, Nekoosa-Edwards Company, Williamson, of

Strathmore Company, Dr. Risteen, of The Travelers' Insurance, and President Stokes, of the New Haven Paper Company, set a pace which has influenced all succeeding sessions. Indeed, even a cursory reading of the proceedings of the section year by year explains why the Paper Section, numerically smaller than the Automotive, Metals, Railways, Mining, and Public Utilities sections, has maintained an almost aristocratic distinction in its programs, bulletins and safe practice pamphlets, meanwhile holding a place of influence in the National Safety Council.

From no mere theorists on safety did the influence of the section spring. Consider, for instance, the remarkable performance of the first plant to be known as "The Safest Paper Mill in the World." That distinction was earned by a remarkable and well-organized run of 150 days in a mill of some six hundred employees. It was the pull of actual performance that set up a "no accident" goal as an everyday dream of some forty odd paper mills.

ACCOMPLISHMENT

Under open-minded leadership it is not surprising to find, as early as 1920, 19 paper mills responding to the suggestion of the National Safety Council that scientific safety methods depend upon accurate statistics. An exchange of accident experience was begun which has met with increasing interest. By 1924, 62 mills were filing reports with the Council statisticians. For purposes of study and comparison these figures have been published every year, the companies being relieved of embarrassment by the use of key numbers instead of names. However, the appeal to the competitive spirit was not lacking as the companies were given rank on the basis of their safety achievements. It is illuminating to note that notwithstanding the anonymous pres-

tige achieved, "Company 14," of the 1920 lineup, has managed to elbow its way up to eighth place by 1925, for all that 62 companies were now in line. Another company, with 900 employees, a little more easily identified, advanced from its early rank of 24, to 14. A notable achievement was that of a company, apparently out of the running with a handicap ranking of 52 in 1920, advancing in four years to seventeenth place.

Meanwhile, equally worthy of note was the performance of the section as a whole. While the original 19 mills found themselves tagged in 1920 with a severity average of 2.598, by 1924, merged with the larger reporting body of 62 mills, adding 7000 more employees to the hazards of the section, they were able to smile because of a reduced rate of 2.065.

Some idea of the truly fine safety work done in the industry is reflected by the reports of 46 of the total 62 mills. With a man-power of 27,213, these companies made the remarkable average of .676. Analyzed more carefully, 6 of these ambitious mills surpassed the record of the mill that stood first in 1920; 19 mills beat the record of the mill that stood second; 26 mills made a better showing than No. 3 mill; 31 mills outstripped the performance of No. 4, while all but two took better than fifth place of the earlier showing.

INTER-MILL CONTEST

It was a unique inter-mill contest that brought the Paper Section to the forefront in the safety movement during the past year. Forty-one mills dared the spot-light of merciless publicity in response to the suggestion of an industrial magazine, *The Paper Industry*, that the good being accomplished by individual mills prominent in safety contests could be multiplied indefinitely by the section as a whole.

Notwithstanding rather hurried preparation, the contest ran through the month of August and found ready participation from mills the length and width of the country. From the beginning, with such eminent contenders as the Kimberly-Clark Mills, the Mead Company, the Strathmore Mills, Nekoosa-Edwards, and an unknown number of dark-horse companies, quietly trained in local contests, it was evident that nothing less than a perfect record would touch the cup. Nevertheless, even the National Safety Council, accustomed to safety stunts, was stirred at the Cleveland Congress by the presence of representatives of 16 paper mills, all with perfect records, and with perfectly valid hopes of carrying home the trophy.

In making the award it was necessary for the referee to calculate an equalization factor for each mill, taking into account the number of men employed and existing hazards as reflected by insurance rates. The cup was awarded to the Port Edwards Mill of the Nekoosa-Edwards Company, one of the charter mills of both the National Safety Council and the Paper and Pulp Section. The fifteen other mills, in the order of their standing as established by the equalization factors, are as follows:

The Niagara Mill of the Kimberly-Clark Company, Niagara, Wis.

The Kimberly Mill of the Kimberly-Clark Company, Kimberly, Wis.

The Niagara Falls Mill of the Kimberly-Clark Company, Niagara Falls, N. Y.

The Menominee Mill of the Marinette & Menominee Paper Company, Menominee, Mich.

The Marinette Mill of the Marinette & Menominee Paper Company, Marinette, Wis.

The Defiance Paper Company, Niagara Falls, N. Y.

The Port Angeles Mill of the Paraffine Companies, Inc., Port Angeles, Wash.

The Fort Howard Paper Company, Green Bay, Wis.

The Woronoco, No. 2 Mill of the Strathmore Paper Company, Woronoco, Mass.

The Mittineague, No. 1 Mill of the Strathmore Paper Company, Mittineague, Mass.

The Chillicothe Paper Company, Chillicothe, Ohio.

The Emeryville Mill of the Paraffine Companies, Inc., Emeryville, Calif.

The Sumner Mill of the Paraffine Companies, Inc., Sumner, Wash.

The Mittineague, No. 2 Mill of the Strathmore Paper Company, Mittineague, Mass.

The Lincoln Mill of the Lincoln Pulp and Paper Company, Ltd., Merritton, Ont.

The Spanish River Pulp and Paper Company, two mills entered, and a thousand men enrolled, lost by a single accident in each mill. The Mead Pulp and Paper Company, formidable contenders for the world's title, likewise lost by an unfortunate single accident.

APPEAL TO SPORTS INSTINCT

The contest method in safety, affirm the leaders of the Paper Section, is in keeping with the gaming instinct, normal in all healthy individuals and especially strong in American workingmen. Set up Old-Man-Accident as a rival to be met and defeated by human intelligence, rather than a Jinx-Ogre to be feared; make safety a game of wits and organization, and the battle is half won. These leaders are convinced that a demonstration of the contest method would be a contribution to American safe practices worthy of any industry. And they covet the task for the Paper and Pulp Section.

They point to the achievements of individual paper mills as proof of the effectiveness of extended contests in promoting industrial safety as a habit. A month without accident never fails to whet the sporting appetite of a mill for a three-months effort. Mills that reach the three-months goal invariably

prime themselves as rivals of the famous Niagara, Wisconsin, "six hundred." The Nekoosa-Edwards crew, with the August Cup, confessed their purpose never to rest until they shall have inspired fear into Kimberly, world-champion among paper mills.

The officers of the section, heartened by the showing made by 41 mills in this year's August contest, are rallying the section as a whole for a contest to run six months, starting January 1, 1926. Their goal is "Make Safety a Mill Habit." They are asking for an entrance list of 50 mills and they hope to kindle interest to the fighting point and to maintain it for the half year no matter what may befall individual contestants, in order to make a showing as a section.

Already they are banking upon past performances in a dozen mills, eminent because of individual no-accident records of three months and over, assured that six months is not an impossible goal. Companies strong for the contest plan already have found "a safe year" a not-impossible period. Safety, in certain Wisconsin paper towns, attracts attention beyond that accorded athletic teams. Human ingenuity, rather than becoming exhausted by efforts to maintain interest, finds continued novelty in parades, vaudeville performances, and departmental stunts. At Kimberly, it is related, the interest in a safety contest ran so high during 1925 that public meetings, usually held on Mondays, had to be changed, the housewives complaining that popular events must not be held on wash-days!

The contest appeal makes it easy to install health measures. The Fort Howard Mill, Green Bay, Wisconsin, found itself impelled by safety spirit to institute vision tests, and later, a dental survey. Over a hundred employees, carried forward by their new interest

in the game of safety, subscribed at two dollars a head to a standard health magazine.

Human life, not to mention business economy, the paper industry discovers, justifies the use of cash prizes, safety bonuses, and all the rewards and medals so dear to the hearts of average people. Tied up with the safety movement are unexpected interests. The plant safety committee acquires influence throughout the entire field of employee welfare and surprises management by its breadth of vision. As a speaker at the last meeting of the section put it:

Safety affords a constant and steady point of contact between the office and the industrial working man at a point where the working man's interests are paramount. Out of a safety committee may come innumerable chances for understanding in other directions.

One paper mill, already successful in kindling interest in safety, found its employees attentive to the proposition that waste of any kind is a direct charge upon industry which working people ought to help to meet. A common plane of understanding, so important in industry, finds itself in connection with the spirit of good will engendered by the safety program. A speaker of strategic influence has repeatedly gone the length of telling the paper industry that safety enthusiasm should be directed toward protecting American mills against European aggression, threatening wages, home conditions and American standards of life. Safety contacts break down suspicion and bring men together in new fellowships, kindling new interests and developing new capacities.

Put safety on the contest plan, says the Paper Section. Tie it up with the play interest, with both office and employees signed for the game. Only time will reveal the possibilities to be achieved.

Safety in the Textile Industry

By G. H. VAN EMBURGH, JR., B.S., M.D.

Medical Director, The Clark Thread Company, Newark, New Jersey

OUR earliest records show that cotton raising, and hand-spinning and weaving were carried on in India at least five centuries before the beginning of the Christian era. More than two thousand years ago, in Delphi, the finest of muslins were woven by hand-weavers from hand-spun yarns. At the present time, thousands of natives still sit cross-legged, as did their ancestors, before the same type of loom, and throw their shuttles by hand, weaving the sheerest of fabrics which the combined efforts of civilization have failed to reproduce by power-driven machinery.

With the introduction of Cartwright's first power-driven loom, operated by water power in England in 1787, the need for safety came into existence. Prior to this, the relatively safe occupation of hand-spinning and weaving was one of the most extensive and widely disseminated of the domestic industries of Europe. But with the coming of water and steam power, domestic spinning and hand-loom weaving gave way, for the greater part, to the more hazardous and productive methods of machine operation.

The need for safety, which was thereby created, lay dormant until the world's consumption of textile products brought about the present day factory system with its mass production. Today the employment of thousands of human beings in a single textile plant has created hazards which previously had not existed. These have only recently been brought to our attention, making us realize the need for adequate protection of the lives, limbs and health

of our employes. The problem of protecting our workers is a widely diversified one, embracing sanitation, medical supervision, welfare work and accident prevention.

The enactment of compensation laws gave the first real impetus to the safety movement in the textile industry. Prior to that time industry's effort toward safety was devoted to the application to its machinery of such mechanical safeguards as were required by the state laws. And, as the laws varied to a very marked degree, the results, when considered from the viewpoint of unified accomplishment, were far from satisfactory. However, the passing of the compensation laws created a real financial hazard of sufficient import to cause the industry to study the problem from all angles.

It is necessary that dangerous points of operation, such as belts and pulleys, gears and fly-wheels, be properly guarded. But in mills where every conceivable safeguard has been installed, it has been found that accidents have been reduced only 14 per cent. Therefore 86 per cent of the accidents have been due to some fault of the employes themselves. Unless the employes are educated in safety methods, both as regards accidents and health, little real good can be accomplished.

The National Safety Council, in its report of 1924, furnishes a summary of the accidents occurring during the year in twenty-one textile concerns. This summary is interesting in that the number of accidents occurring on each kind of machine is listed, thereby affording the safety director a means of deter-

mining the actual hazard or risk attached to the various operations.

Total number of employees..... 27,129
Total number of hours worked..... 53,196,653

Number of Accidents

Deaths and total disabilities..... 3
Permanent partial disabilities..... 31
Temporary disabilities..... 567

Total number of accidents..... 601

Number of Days Lost

Deaths and total disabilities..... 18,000
Permanent partial disabilities..... 18,506
Temporary disabilities..... 10,750

Total number of days lost..... 47,256

Average frequency rate..... 11.29
Average severity rate..... .889

	No. of Accidents by Causes	No. of Days Lost by Causes
<i>Mechanical</i>		
Rope-making machines..	5	37
Braiders.....	1	11
Shear and napping.....	..	....
Dyers, washers, jigs and fulling.....	14	7,510
Calenders, mangles and dampeners.....	5	609
Drying and winding....	3	18
Folders and doublers....	..	....
Printing.....	2	90
Tenter and mercerizer..	2	77
Coating, slashing and starching.....	1	3

Pickers, cards and combs	48	13,146
Spinning and twisting..	36	2,768
Weaving.....	43	650
Knitting.....	2	7
Loopers and sewing.....	3	27
Maintenance machines— woodworking.....	3	1,228
Maintenance machines— metalworking.....	13	151
Power transmission and boilers.....	4	386
Elevators.....	7	575
All other machinery....	22	4,170

Non-Mechanical

Vehicles—highway.....	3	134
Vehicles—inside plant..	15	379
Hot substances.....	9	113
Electricity.....	2	22
Poisonous substances...	7	133
Falls of persons.....	79	4,626
Stepping on or striking against objects.....	41	575
Falling objects.....	47	821
Handling objects.....	102	1,728
Hand tools.....	14	115
All other causes.....	68	7,147
Totals.....	601	47,256

But this summary does not fix the responsibility for the accidents recorded. For this purpose, I have used the following classifications at the Clark Thread Company's plant:

CLASSES OF RESPONSIBILITY

(1) UNAVOIDABLE:

1. *Act of God:* (Such as accidents caused by lightning, storms, etc.)
2. *Unknown Physical Deficiency:* (Apoplexy, hernia, hemorrhage from lungs and other physical injuries caused by strains, etc., incurred from handling weights, etc., which should be lifted without danger by the average man.)
3. *Risk of Employment:* (Accidents caused by manufacturing conditions which with our present knowledge of the subject we see no way as yet to prevent.)

Cause of
14 per cent of
Accidents

(2) FAULT OF EMPLOYER—AVOIDABLE:

1. *Defective Construction or Equipment:* (Accidents which could have been prevented probably by a different construction, or changes in our equipment.)
2. *Lack of Safety Appliances:* (Due to our failure to provide safeguards, railings, etc.)
3. *Lack of Proper Supervision:* (Failure on our part, or through our officials down to the foreman, to properly supervise, educate or instruct the injured employee.)

(3) FAULT OF INJURED—AVOIDABLE:

1. *Negligence or Lack of Skill:* (Carelessness or ignorance.)
2. *Disobedience:* (To rules or instructions—printed or verbal.)
3. *Skylarking:* (Fighting, horseplay, showing off, etc.)
4. *Unsuitable Clothing:* (Only where employees have been warned of the danger.)

Cause of
86 per cent of
Accidents

5. *Non-use of Safety Appliances:* (Includes removal of safety appliances, or failures to make use of them.)
 6. *Failure to Report Injury:* (Where this has caused, or contributed to the accident, as in the case of infected wounds.)
 7. *Poor Housekeeping:* (When within the control of the employe injured.)
- (4) **FAULT OF FELLOW EMPLOYE—AVOIDABLE:**
(Same as for "Fault of Injured.")

Two or more responsibilities may be assigned to any one accident if it is felt that both contributed—for example: "Negligence of Employe and Lack of Safety Appliances."

In assigning responsibility on the injury reports, do not insert the words "Avoidable" or "Unavoidable." If desired, the responsibilities may be given by the use of the above numbers, thus: 2-1 and 3-2, indicating "Defective construction and disobedience of injured."

This has overcome the tendency, too often found, to classify all accidents as due to carelessness alone. A careful analysis of accidents is essential in order that the necessary steps may be taken for the removal of their causes. Education of the employe is of the greatest necessity, for each individual worker sees a serious accident so seldom that he is not aware of the magnitude of the problem. And as some measure of carelessness and indifference is found in almost all of our employes, the good obtained by safeguarding our inanimate machinery is far overshadowed by the harm caused by the lack of safeguards for our human machinery. The best safeguard for the latter is enlightenment of the individual by education along safety lines. And no effort at safety can approach more than partial success unless this is accomplished.

SAFETY LINEUP

In organizing a textile mill for safety, it is necessary that two sets of committees, one composed of the workers, and the other of the executives, be organized. The workmen's shop committees should be given definite duties with regard to safety and sanitation in their departments, and should be held directly responsible by the manager's or executive committee. The members of the workmen's shop committees should serve for three to four months

and should then be replaced by other members from their department. By doing this, each department will gradually acquire a number of workers who have been carefully instructed in safety methods and who, due to their experience on the committee, will remain ardent safety boosters. These workers will also carry the messages of safety to their fellow workers.

The interest of the committee members can be maintained by frequent meetings, lectures, motion pictures, and demonstrations. It has been found profitable in some cases to take these members in a body to safety museums and exhibits.

INTERESTING THE RANK AND FILE

But our real problem is to interest the rank and file of our employes in the safety movement. If we educate them in the safe way of doing things, and if we keep up their interest in safety, the most difficult part of the desired result will have been accomplished. We will have provided the workers with a guard which they will carry with them everywhere, and which will either protect them entirely from accident, or which will prevent their trivial injuries from becoming serious.

The insurance companies, together with the National Safety Council, have provided a bulletin and educational service which has been of the utmost

assistance, in that it has brought to the worker direct information as to the causes of accidents. It has also pointed out for the benefit of the workers the ease with which accidents may occur—little slips that result in disaster—the results of thoughtlessness. And it has put these subjects in such a way that the worker is appealed to from within. He is made to feel that safety is for him and to his advantage, and that if he does not observe safety, he will be the chief loser.

The National Safety Council has also been performing a valuable service in the dissemination of safety literature among its members and in publishing accident analyses, which have made it possible to demonstrate the value of safety. They have offered a consultation service which has been of value, and they are now preparing a safety code for the textile industry. This code is an effort to establish a standard of minimum requirements for the safe operation of textile mills. It will be a reference to which manufacturers may turn for help with their problems of guarding and safe construction. And it is possible that it may later be adopted by the various states and its provisions made compulsory. While the code sets forth the minimum requirements, a plant, to be thoroughly organized for safety, will, of necessity, have progressed beyond the prescribed limits.

The newer mills that have been developed in the South have an advantage over some in the Northern states. Many of these Southern mills have been started in small communities or in places where there were formerly few inhabitants. It has been necessary for them to build their own towns and villages, and the companies have constructed their own schools and churches. The population that has come to these places is directly under the influence of the company.

Because of this situation, the company has a constant opportunity to supervise the health of its workers, and to drive home lessons of safety, both in living and working conditions. This plan is in general comparable to that of several New England mill towns.

ENLISTING MEDICAL AID

The medical department may be of great aid and should render every possible help in the promotion of safety in industry. That medical organization, which limits its activities to the treatment of mill injuries alone, is little more than a first aid department, and its value to industry is small indeed. It fails to perform several services of vital importance, and it misses its real opportunity for service.

All new employes should be examined to determine their fitness for the work that they are about to undertake. A complete physical examination is desirable. But, where company policy dictates a lesser procedure, the doctor or nurse can at least estimate the applicant's general physical fitness; and from careful inspection and questioning, may discover infirmities which, if they remained untreated, would make the employe a hazard and liability.

There is seldom an objection raised to the taking of an applicant's pulse and the testing of his vision, but these simple procedures often reveal troubles of a serious and important nature.

As manufacturing processes have become more highly specialized, employes have often been given jobs requiring the frequent or constant repetition of certain motions with little consideration of their physical fitness for such work. This has resulted in misfits and often serious accidents. Employers must realize that it is to their advantage to look after the health of their employes, and to protect them from accident. A healthy, contented worker, in posses-

sion of all of his faculties, is an asset and will make money for his employer. But if not properly guarded and directed, this worker may quickly become a liability.

Every employe who has suffered a serious accident should be required to undergo a careful and complete examination to determine if some physical frailty was the cause of, or contributed to the accident. It has been found in many cases that momentary lapses of attention sufficient to cause a serious accident have been due to eye strain, habitual constipation, indigestion, and other equally easily remedied conditions. Chronic kidney trouble, heart disease, and high blood pressure are often found to be contributing causes; and unless steps are taken to prevent future accidents, dire results may ensue.

By encouraging or compelling the reporting of all accidents, no matter how slight, infections may be kept at a minimum and serious losses prevented. A friendly attitude and competent treatment by the medical department will do much to lessen the length of disability.

The amount of permanent disability resulting from injuries may be greatly lessened by means of physical reconstruction and rehabilitation. If dispensary treatment is given for personal conditions developing during mill hours,

supply and facilities, of toilets, wash-rooms and dressing-rooms. The cleanliness of the mills in general as regards sanitation and hygiene should be carefully watched. The workers should be educated in the proper methods of personal hygiene, and special emphasis should be laid on suitable clothing.

In plants which maintain cafeterias, all food handlers should be thoroughly examined and then periodically re-examined. And all food supplied to workers should be above suspicion.

All of these duties of the medical department contribute directly to the safety of the workers. They are all necessary if the maximum benefits are to be derived from the safety movement.

RECORD OF CLARK THREAD COMPANY

Many plants included in the twenty-one listed previously have made noteworthy records of safety achievement; outstanding among these is that of the Clark Thread Company of Newark, New Jersey, manufacturers of Clark's O. N. T. Spool Cotton. A little less than four years ago, this plant organized safety committees and undertook the launching of a safety campaign. This movement has been kept under way ever since, and they have made the following remarkable record and savings:

	1921	1922	1923	1924	First 10 Months 1925
Frequency rate of major accidents.....	18.29	12.56	3.01	1.79	.311
Severity rate of major accidents.....	2.08	1.498	.679	.161	.014

the employes are often relieved of annoying aches, pains or distress and they are permitted to perform their work with a mind unannoyed by distracting thoughts. The medical department should also conduct periodic sanitary and health surveys of the mill, to determine the condition of drinking water

These frequency and severity rates have been computed by the National Safety Council's method.

By major accident is meant an injury involving a permanent disability, or one which necessitates loss of time in the shift next beyond the one in which the accident occurred.

Expressed in another way, the actual number of their injuries was:

The cases of major injuries that have received no compensation were ones in

	First 10 Months				
	1921	1922	1923	1924	1925
Number of major accidents.....	157	120	29	16	2

These figures show a remarkable decrease, which is still more impressive when one considers that their accident rates for 1921, at the start of their campaign, compared favorably with those of several mills which have recently engaged in safety work, and whose records are available. The improvement has been made in a mill where safeguards and ordinary safe working conditions had been in existence for years. But these were insufficient.

These rates are based upon the actual number of working hours during which the employes were exposed to hazard. Therefore, no further correction is necessary for those periods of depression which occur in manufacturing, except as it may influence the actual number of injured, and this variant is very small in proportion to the total exposure.

Figures such as these show that it is possible to save many employes from painful and often crippling injuries, if we will only use all of the means at our disposal. The Clark Thread Company feels that by means of its efforts it saved at least 100 of its employes from suffering and misery last year.

If the major injuries are divided into three classes for the purpose of further study, the following figures will be found of interest:

which the disability did not extend beyond the ten-day waiting period prescribed by New Jersey law, and for which the employe was entirely responsible, the accident occurring as a result of said employe's disobedience of a company rule of which he was fully aware.

The company's saving in accident charges is manifest. The number of permanent compensation cases is not a true index of these injuries. They are in proportion less than in 1921, but are made to appear larger by a revision of the State Compensation Law. This law has been made more stringent, and rightly so, until every case of stiffness, loss of motion, function or strength in any part of the body is now classified as a permanent disability. And such disabilities must be compensated for in the proportion they bear to the total for the injured member. There is a growing tendency to see that the workman is fairly dealt with after an injury, and that his family is adequately provided for. This, of course, will cause a sharp rise in accident charges. The only way that this increased expenditure of company money can be minimized is by the vigorous application of safety.

The aforementioned company has made a very decided saving in compensation, in spite of the fact that in July, 1923, an act of the state legislature

	First 10 Months				
	1921	1922	1923	1924	1925
Involving no compensation.....	53	45	11	3	0
Involving temporary compensation only.....	100	65	12	7	2
Involving permanent compensation.....	4	10	6	6	0
	157	120	29	16	2

raised the compensation rate from \$12.00 to \$17.00 per week.

Many other plants are carrying on well organized and effective safety

	1921	1922	1923	1924	First 10 Months 1925
Compensation paid injured employees . .	\$8,012.40	\$7,119.77	\$5,426.18	\$2,278.92	\$264.99

These compensation charges are figured against the month in which the accident actually occurred, although the payments may continue for many months or even years later.

The actual number of hours lost from work by their employes has been remarkably reduced:

	1921	1922	1923	1924	First 10 Months 1925
Actual number working hours lost because of accidents . . .	7442	8395	3491	3958.5	734.5

Consider what this means in terms of quality and production. Over 6000 lost hours less during the first eight months of 1925 than during a similar period in 1921!

Last year this plant made the remarkable record of 156 consecutive calendar days without a major accident. It has done even better this year and has just passed its 262nd day without a major accident—eight months without a single major accident, and this in a plant of 5000 employes!

campaigns, and they, too, are accomplishing excellent results. It is, therefore, a source of surprise and wonder that out of the 2350 textile plants in the United States, employing 100 or more operatives, only 121 are members of the National Safety Council. However, this number is certain to be in-

creased as the benefits to be derived from the safety movement become more generally realized.

The period of depression through which the textile trade has lately been passing, has seriously checked the development of safety in many mills. This should not be the case, and as mill managers come to realize that safety can make real savings for them, periods of depression will be ones in which further stress will be laid on the necessity for care and the preservation of health and limb.

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Safety Progress in the Woodworking Industry¹

By JOHN A. DICKINSON

Consulting Mechanical Engineer, U. S. Bureau of Standards

THE entire woodworking industry may be divided into two main processes—the manufacture of lumber and the manufacture of products into which lumber enters as a raw material.

The working of timber is one of our oldest manufactures, probably antedating even the working of metal, and, as far as it applies to the actual felling of trees, the process has changed but little during the past dozen centuries.

The axe is a tool whose origin is lost in the mists of antiquity; saws of a sort have been known for centuries. These are still the tools of the feller of trees.

The advent of steam and, more lately, the electric motor, however, have had a marked effect on the transportation of logs from the forest to the point of utilization. The old ox team is rapidly giving way to the steam skidder, while the locomotive has, except in a few localities, almost entirely replaced the flowing stream as a means of transporting logs to the mill.

REDUCING LOG-HANDLING HAZARDS

While the application of power to the handling of logs has reduced by a large percentage the number of men necessary to handle a given number of logs and has thus reduced the total exposure, the mechanical appliances themselves have introduced additional hazards. While much attention has been given to the design of power logging equipment, the severe exposure which such machines must withstand and the unusual strains that may be

thrown upon them by the “hang-up” of logs on stumps or other obstacles may result in failures which will endanger men in the immediate vicinity. A periodic inspection of such equipment by a competent man is one of the fundamental requirements for the safe operation of such equipment. Moving parts, such as cranks, gears, shafts, etc., should be suitably inclosed.

Logging railroads were formerly fruitful sources of accident; the tracks were almost without exception narrow gauge, of very light weight steel, and poorly ballasted. Frequent derailments, spilling of part of the load and similar accidents made it evident to the operators that it would be a real economy to use heavier equipment and provide better road-beds.

Another economic factor has had a marked influence on the type of construction employed on logging railroads; namely, the development of cut-over lands into agricultural communities. In many cases the logging operators can sell the cut-over land for as much as or more, than it cost originally, but, as many such locations are practically inaccessible except over the logging railroad, the operator has been forced to provide passenger and freight accommodations for settlers who purchase his land. As more and more lumber is cut and the number of settlers increases, this service becomes increasingly important.

Where the logging railroad was started as a broad-gauge line and was equipped with a moderately heavy rail over a well-graded road-bed, it is quite probable that when the cut-over lands have been settled some railroad

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company in the vicinity would be glad to take over at a reasonable price such logging road as a branch of its own system. A number of the branch lines of the Michigan Central, Duluth South Shore and Atlantic, and the Chicago, Milwaukee and Sault Sainte Marie in Michigan and Wisconsin started as logging roads.

The ultimate development of this idea is well exemplified by the railroad built by the Great Southern Lumber Company to supply transportation of logs for their need at Bogalusa, Louisiana. This is a standard-gauge road almost 200 miles long, running standard equipment on all trains; excellent chair-car and dining-car service are also furnished. The road-bed compares favorably with that of any railroad in the section.

Obviously the hazards of transporting logs over a road of this kind are much smaller than handling them over the old light-weight, narrow-gauge tracks which were formerly so common.

While river-driving has ceased to be a factor in many localities where it was once common, there are sections of the country where such work is still carried on. Here, too, improvements in layout and equipment are lessening the hazard and increasing the production per man.

The breaking down of log decks, formerly the work of men working on the deck itself with pike poles and peavies, is now being accomplished by drag lines, working on spools on portable gasoline motors, the whole equipment being placed on the opposite side of the river. Rapids have been bypassed by log chutes and permanent or semi-permanent sorting platforms have been provided at various locations on the river to expedite the work and to decrease the hazard to the sorter.

The sawmill itself, because of its temporary nature; the rough and ready type of men employed in it; and the location of the bulk of the largest

mills and the greatest number of mills in states in which there were no compensation laws and no provision for the inspection of physical hazards, was slow to adopt safety measures.

SAFETY IN THE MILL

Passing now from the logging operations to the conversion of logs into lumber, statistics show that a large proportion of sawmill accidents in the past have been machine accidents. The high speed at which it is necessary to run saws to secure efficient production and the relatively large power required for such machines make this hazard unusually severe.

The more slowly moving equipment—conveyors, transfer chains, and the like—bristle with spikes, lugs and similar projections, any of which may catch the clothes of a careless operator and may carry him into saws, belts or pulleys.

While safety measures were slow in being adopted in the lumber industry, their value finally became apparent and the larger operators have done much in the past decade to improve the physical conditions of their mills. Some trade organizations, such as the Southern Pine Association, have been particularly active in spreading the gospel of safety.

Band-saw wheels are now almost always inclosed; slasher and trimmer saws provided with substantial barricades, and edgers equipped with safety dogs, jam rolls or similar devices to prevent material being thrown back at the operator.

The power-fed gang lath mill has almost universally replaced the old hand-fed mill with a consequent decrease in the number of maimed fingers. Shingle saws, while less hazardous than those formerly employed, are still far from being harmless.

While much work has been done in reducing the hazards due to exposed

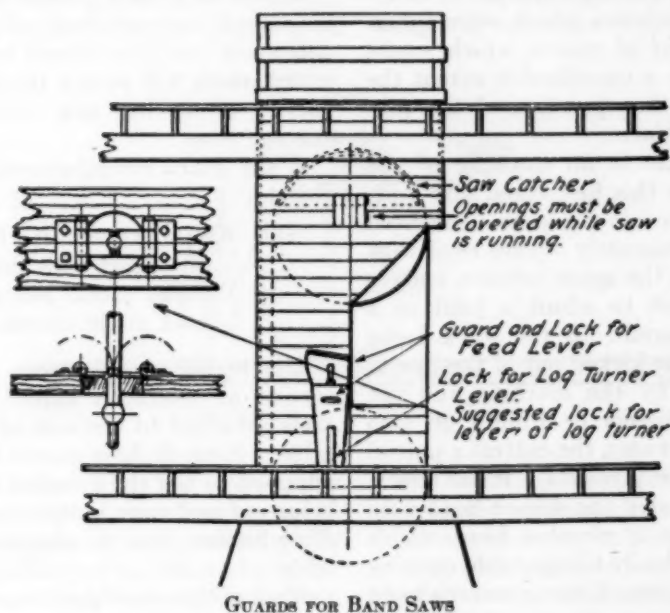
belts, pulleys, shafts and gears, on the main mill floor, unfortunately the mass of power-transmission apparatus in the basement has not in general received such protection, although more attention has been given to such equipment in the past few years than had

proved to be the cheaper construction in the long run and are being very generally employed in new kilns.

The protection of steam pipes in kiln pits and operating booths is becoming common. More attention is being given to the slope of the track

CHART I.

Opening above band mill may be railed, as shown, but a door or other solid covering is preferred.



ever been given it before. The saw-mill operated by a large automobile manufacturer in northern Michigan has all such equipment thoroughly and completely guarded; such an example as this will doubtless have a marked effect on the mills in contiguous territory.

The tendency toward dry kilns built entirely of fire-resisting materials has eliminated a rather common type of accident; that of the kiln tender falling through the partially decayed wood roof while setting dampers in the kiln flues. Concrete and tile have

in the kiln so that minimum effort is required to handle the cars and yet there will be no tendency for loaded cars to build up dangerous velocities.

Lumber-handling and stacking machinery is coming into more and more general use, reducing to some extent the hazards due to manual labor in their operations; but unless carefully guarded such machines may offer new mechanical hazards.

SAFETY IN THE SHOP

Woodworking shops, i.e., plants which use lumber as a raw material,

are found in many industries and, as an integral part of such large manufacturing concerns, have received for a number of years the attention and study of safety engineers.

As is the case with the manufacture of lumber, the woodworking industry has always shown a very large proportion of machine accidents, but a careful study of accident causes and the survey of the hazardous machines which followed, resulted in the development of machines which were inherently safer or of guards which would eliminate to a considerable extent the hazards of the operation of the particular machine.

The jointer is an example of the machines in this first class. As built a generation ago the cutter consisted of an approximately square head with four blades; the space between cutters was sufficient to admit a joint of a finger or thumb. If the stock being fed should be kicked out of the operator's hand by the machine and the operator's fingers or thumb go into the space between the cutters a partial dismemberment results. It was found, however, that if the square head were replaced by a circular head which would practically fill the table opening at all times, even if the operator's hand should come in contact with it only a relatively slight flesh wound would result. Several effective guards have also been developed to cover the jointer head and further protect the operator.

Another improvement in machine design has been the inclosing of knives on stickers, molders and matchers so that there is practically no chance of operators coming into contact with them.

A number of manufacturers are now building woodworking machines in which gears, feed-rolls and similar mechanism, as well as the actual point of operation, are inclosed or made in-

accessible from the usual operating position.

Circular saws have always been a fruitful source of accidents and while some effort has been made to develop a machine-fed saw, such equipment has proved to be of value only where a large production of work of the same nature and dimensions was turned out. In the average wood plant, hand-fed saws are still in the great majority.

A number of saw guards have been developed, some of them of considerable merit, but it is difficult to design a guard which will permit the necessary variety of sawing met with in the average shop.

A saw guard should accomplish two objects:

- (1) Keep the operator's hands out of contact with the saw.
- (2) Prevent stock being thrown back at the operator.

The earlier guards were generally carried on overhead supports or on arms attached to the side of the saw table. Most of these guards had to be adjusted to the thickness of the stock being cut and were in the way in handling lumber over or around the saw table.

Most of the newer guards are carried on a wedge-shaped arm (or riving knife) placed behind and in line with the saw. This is the only point of attachment, the front end of the guard, which is generally beveled to permit the wood being pushed under it to start the cut, being free to ride the lumber being sawed. Kick-backs are prevented by a dog or ratchet which locks the wood against the saw table should there be any tendency toward a kick-back.

The ideal saw guard should, in addition to giving the protection outlined above, allow the operator to see the actual point of operation so that a piece may be cut to a line; it should take up the minimum amount of room

between the saw and the guide; and should be self-adjusting for any thickness of lumber.

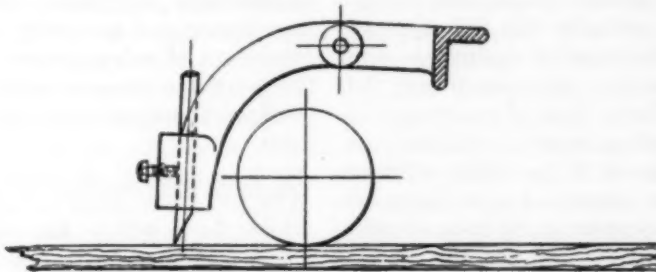
Swinging cut-off saws are now generally being built with a hood over the upper part of the saw; at least one guard has been developed which covers the entire front of the saw, sections of the guard swinging back as it comes into contact with the stock.

Counterweights, which formerly were responsible for a number of accidents, either through the weight dropping off

All of the larger industrial states now require exhaust systems with hoods over the point of operation of each machine. Such systems not only cut down the danger of diseases of the respiratory tract caused by excessive dust, but also greatly reduce the fire hazard by removing the shavings and sawdust as fast as they are produced.

The flooring in woodworking plants should receive special attention as a little fine sawdust greatly increases the danger of operators slipping or falling

CHART II.



ANTI-KICK-BACK DEVICE FOR EDGERS

the arm and striking the operator, or dropping free and allowing the saw to swing forward, are now generally held by an auxiliary stop bolt and are frequently also held by a guard chain suspended from the ceiling as an added precaution.

Wood shapers are generally equipped with guards that give reasonable protection to the operator. When a large number of identical pieces are to be run, very effective combination guards and guides can often be employed.

Double-spindle shapers should have separate clutches for each spindle so that an operator working on one head will not be endangered by the cutter on the other head. Many serious accidents to elbows and arms have occurred on the old-style machines in which both spindles were driven from the same belt or jack-shaft.

while working around a machine. Corrugated rubber mats are used extensively and one-half-inch or three-quarter-inch expanded metal nailed to the floor around machines has also been used to decrease this hazard. Several of the commercial anti-slip surfaces have been frequently employed, although such material should be of a rough enough texture to afford a safe footing even if the surface is covered with a layer of fine sawdust.

Because of the large proportion of machine accidents, the woodworking industry offers a particularly good field for mechanical safeguarding. A well guarded shop will not only greatly reduce accidents but will actually produce more and better product. While much safety work has been done in the past, the industry still offers a fertile field for the safety engineer.

The Guarding of Mechanical Power Transmission Equipment

By VICTOR S. KARABASZ

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IN discussing safety in connection with mechanical power transmission equipment one is treating a subject toward which attention has been directed since the earliest days of factory safety work. The accident hazards of mechanical power transmission equipment were probably the first type of hazard to be guarded against on any considerable scale and even to-day the guarding of this type of equipment is being carried on most energetically in the enforcement of the safety codes of the various states. Large sums of money are spent annually upon guards, and it is but natural for the manufacturer to ask if this expenditure is justified by the actual hazards of the equipment, or whether perhaps guards are not being required where little or no risk is involved. It was with the purpose of ascertaining exactly the conditions under which mechanical power transmission accidents occurred, and the relationship of these conditions to the present safety standards for guarding such equipment, that the writer undertook to make a study of such accidents reported to the Department of Labor and Industry of Pennsylvania from January 1, 1920 to June 30, 1925, a period of five and one-half years. While this study has not been entirely completed there are certain facts which are well established and well worth noting. These have to do with (1) the number and seriousness of mechanical power transmission accidents, as compared with the total number and seriousness of all accidents

and the position in the order of causes of these accidents compared with all accidents together with possible reasons accounting for this position; (2) the present guarding or lack of guarding and its effect upon mechanical power transmission accidents; and (3) the importance and necessity for the development of safe practices in connection with the use and maintenance of mechanical power transmission equipment.

GAUGING SERIOUSNESS OF ACCIDENTS

One fact which has often been stressed is that from the standpoint of the number of accidents mechanical power transmission equipment is not very important. In a tabulation of all accidents reported to the Bureau of Workmen's Compensation of Pennsylvania for the period of January to April (inclusive) 1925 (a typical period), only 140 out of a total of 59,315 accidents were chargeable to this type of equipment. The Bureau uses a classification of twenty-one causes of accidents and from the standpoint of numbers of accidents, mechanical power transmission was nineteenth in importance, boilers and watercraft alone being less important. A rapid glance at these figures would seem to indicate that this type of equipment has been over-emphasized as a cause of accidents, but this by no means necessarily follows. The relatively small number of accidents is likely to be due to a considerable extent to the fact that mechanical power transmission equipment

on the whole is better guarded than any other type of equipment, because of the early realization of its hazards and of the continued enforcement of the safety standards applying to it. Even to-day it is without doubt correct to say that more orders are issued by factory inspectors for the guarding of this class of equipment than any other type. If adequate guarding therefore can reduce accidents, it certainly has had an opportunity to do so here. To point, therefore, to the relatively small number of these accidents and say that there is little danger would be rash without first ascertaining the effect which guarding has had upon keeping the number of accidents low.

Another factor worth considering in this connection is the degree of seriousness of transmission accidents. Although nineteenth in importance from the standpoint of number of accidents, from the standpoint of the number of fatalities, transmission equipment is fourteenth in importance (January to April inclusive, 1925, Bureau of Workmen's Compensation).

The following table, which is a result of a study of the degree of seriousness of mechanical power transmission accidents occurring between January 1, 1922 and June 30, 1925, gives a better conception of this phase of the subject:

MECHANICAL POWER TRANSMISSION ACCIDENTS
JANUARY 1, 1922 TO JUNE 30, 1925

According to degree of seriousness

Part of Transmission	Per	Per	Per
	Cent	Cent	Cent
	Fatal	10+	10-
Belts and pulleys, including ropes and sheaves...	2.5	56.5	41.0
Shafts, couplings, clutches, etc.....	15.3	59.0	25.7
Gears.....	5.3	79.0	15.7

10+ = Disability more than 10 days.

10- = Disability 10 days or less.

A glance at this table shows the large percentage of transmission accidents

which result either in death or in disability lasting more than ten days. Management and workers should realize that although transmission accidents may occur infrequently in a given factory when compared with other types of accidents, this should not be interpreted as meaning that this type of equipment need not be guarded, but rather, mindful of the usual seriousness of such accidents when they do occur, should be forever vigilant to prevent their occurrence both by adequate guarding and by care in the use and maintenance of such equipment. The relative infrequency of accidents of this character has, in some instances, developed a false sense of security both on the part of factory executives and workers as a result of which, carelessness, both in the provision and replacement of guards and in the handling and care of such equipment, has in many instances resulted in very serious and even fatal accidents. A study of Pennsylvania's mechanical power transmission accidents reveals case after case where this false sense of security has been the real cause of the accident. In such cases the factory executive usually prefaces an explanation of the cause of the accident by telling how long a period elapsed since the last transmission accident. Further explanation and an inspection of the plant generally show how unsafe conditions have been permitted to arise, and how the very serious or fatal accident directly resulted because of these unsafe conditions and the false sense of security resulting from the recent absence of such accidents.

PRESENT STATUS AND RESULTS

In view of the relative infrequency of mechanical power transmission accidents noted above, it is particularly desirable to study the effect of guarding upon such accidents, especially from

the standpoint of whether or not the present standards are not too severe and whether they provide against hazards which do not exist, or whether or not the standards are not sufficiently severe in that they do not provide against the actual hazards. All aspects of the writer's study of this subject covering the five and one-half-year period from January 1, 1920 to June 30, 1925, have not been completed. However, the portion of the study completed to date, which covers the broader aspects of the subject, seems to indicate conclusively that the following statements in regard to the conditions under which this type of accident occurs are correct:

(1) Guarding according to the present standards is one of the best guarantees that transmission accidents will not occur at the point so guarded. It is only under the most unusual circumstances that a transmission accident will occur at a point properly guarded. The statement that guards increase the hazard is not borne out in the investigation excepting in very exceptional cases on special machines. On the other hand there is an abundance of accidents when the standard guards which have been provided are removed and not replaced.

(2) Many accidents occur at points which should be guarded according to the existing standards but which for some reason or other have not been guarded. The above two points indicate clearly that there is a direct relationship between guarding or lack of guarding and the number of accidents resulting. They also seem to indicate that the present standards provide against actual hazards.

(3) Most mechanical power transmission accidents occurring at the present time result from unsafe practices in connection with the use and handling of such equipment and are not directly

connected with the guarding problem. By this is meant that transmission equipment cannot be so thoroughly guarded as to preclude accidents which result from the unsafe methods of workers. As long as workers persist in oiling and cleaning or repairing and testing equipment while in motion, carelessly shifting or applying belt by hand, carelessly applying belt dressing, working with loose clothing amid the rapidly revolving shafts near the ceiling and in dozens of other similar practices, transmission accidents will continue to occur. It is this problem of the adoption of safe practices in connection with mechanical power transmission equipment, rather than the increasing or decreasing of the severity of the present standards—except in a few minor instances—which offers the greatest possibility in the prevention of accidents in connection with this type of equipment. An interesting reaction from a number of plant executives with reference to the guarding problem was their desire to see the manufacturers of machinery compelled to equip the machines which they sell in the state with standard guards. Most factory men wish to see their machinery neatly guarded and they rightly feel that the manufacturer of the machine is in the best position to equip his machine with a standard, neat guard, which will not be in the way and which will not, in its bulkiness and clumsiness, present an amateurish appearance. This idea has already been adopted by a few manufacturers of machinery and it must be said that their machinery presents a much neater appearance and is generally adequately guarded in a way which does not interfere with operation.

A number of serious accidents were found to have occurred in cases where machinery was operated before an adequate guard was provided. These occurred in cases of new or second-handed

machines being operated while the guards were being made, or where old machinery was moved from one part of the shop to another, necessitating the manufacture of new guards, or in the failure to replace the old guards before the machinery was operated. The frequency of these accidents necessitates special care to see that machinery is not operated under these conditions.

UNSAFE PRACTICES

On the whole mechanical power transmission equipment is about the best guarded type of equipment. The problem of safety is (1) to see that the present standards are enforced so that as much of the hazard as can be removed by guarding will be removed, and (2) as important as guarding is the development of a code of safe practices for the use of the worker who may have anything at all to do with such equipment, and study shows that everyone from superintendent to laborer may fall into this class. There are two aspects of this subject: (1) that which has to do with the use of the right kind of equipment properly applied; and (2) that which has to do with sheer ignorance and carelessness on the part of the workers.

Many accidents could be avoided if there was a more widespread knowledge of a few practical points in connection with belt economy, and not only would accidents be reduced but there would also result a real saving in dollars and cents to the users of belting. Belts poorly chosen for the power required on given operations, continually running off pulleys, slipping, stretching, poorly joined with an ill adapted type of lacing, continued overuse of belt dressing wrongly applied, have been the causes of untold numbers of accidents, and probably will continue to be so in the future unless there is more general knowledge concerning these matters.

The same thing holds true although to a lesser degree with the other types of transmission equipment.

The carelessness and ignorance of workers and the false sense of security while repairing, oiling, cleaning and testing mechanical power transmission equipment while in motion, in working amid rapidly revolving overhead shafts with loose clothing, in taking chances in order to save a few moments when chances are unnecessary, and in almost innumerable other ways, have resulted in sending many to untimely deaths, and others to hospitals with serious injuries. Workers do not realize the great dangers to which they expose themselves by these practices. This is primarily a problem of safety education¹ and if properly conducted should result in a reduction in the accident rate where most transmission accidents are now occurring. Next to the maintenance of the present standards of guarding, it is in the provision of codes of economical and safe practices that most can be done in the reduction of mechanical power transmission accidents at the present time.

Mechanical power transmission accidents, although relatively few in number probably due in no small degree to guarding, are usually serious and have warranted all the attention which has been devoted toward their elimination through the years. The present problem in their prevention is neither the increasing nor decreasing of the severity of existing standards—except with one or two minor exceptions—but rather the continued energetic enforcement of present standards, together with a campaign of safety education to extend to both management and men, setting forth a series of rules covering safe practices in connection with mechanical power transmission equipment.

¹ See Section VI of this volume.—THE EDITOR.

Point of Operation Guarding

By GREGORY C. KELLY

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THE point of operation of a machine has heretofore been defined as "that part of the machine where stock is actually inserted and maintained during any process of forming, shaping or other necessary operation." In reality, the term "Point of Operation" is in itself a misnomer since all parts of a machine must of necessity operate together. What has really been meant by "Point of Operation" is "Point of Danger" and it is true that there is a special hazard specific to certain machines when they are operated without protection. This special hazard of machines is merely a new description of an old term. Hand-fed machines and machines emitting particles of abrasive material or metal cuttings are the most common of the machines with such a special hazard. For example, nine out of every thousand accidents¹ in furniture manufacture are loss of hand and eleven out of every thousand in machine shops are loss of eye. Such losses alone indicate special hazards in these industries and a further study discloses the fact that the accidents are caused by particular machines operated without sufficient protection.

Special hazards are common, not alone to furniture manufacture and machine shops, but to all industries. In mining and quarrying, the special hazard is falling rock; in building construction it is falling persons or materials; and in the manufacturing industries, since they are mechanical in nature, it is a mechanical special hazard

which is responsible for the accidents. This is true to such an extent that in the Pennsylvania factories, one-third of the lost time from work accidents is attributable to working machines.² These working machine accidents vary from ten per cent of all accidents in foundries to sixty per cent of all in woodworking and sheet metal goods manufacture. The importance of the special hazards of particular machines is indicated clearly in the tabulation of working machine accidents which follows:

ALL MANUFACTURE—MACHINE ACCIDENTS

Part of Machine on Which Accident Occurred	Days Lost ³ (Weighted)
All working machine accidents	1,542,344
Point of special hazard:	
Point of operation	884,595
Feed rolls	15,527
Kick-back or thrust of work	183,500
Flying particles	135,955
Belts and pulleys	47,841
Gears and sprockets	62,925
Revolving projections	20,836
Other moving parts	59,857
Breaking of machine	58,823
All other machine causes	72,485

² Working machines are here differentiated from boilers, engines, pumps, cranes, electrical apparatus and mechanism used purely for the transmission of power.

³ The accidents on which this tabulation is based occurred during three- and one-half years in Pennsylvania factories. The accidents are weighted for the benefits provided by the Pennsylvania Compensation Act, which affords compensation over all of \$2700 for Fatality, \$1600 for Major Permanent Disability and \$48 for Temporary Accidents averaging forty days duration of disability.

¹ Accidents of more than ten days duration of disability.

The importance of safeguards for these special hazards is further illustrated in the following similar tabulations for separate industries:

WOODWORKING ⁴

Part of Machine	Days Lost
All woodworking machine accidents	221,874
Point of special hazard of:	
Jointers	31,776
Shapers	13,977
Hand-fed circular rip saws	105,219
All other machines	62,633
All other machine accidents	8,269

MACHINERY MANUFACTURE ⁵

Part of Machine	Days Lost
All working machine accidents ..	484,057
Point of special hazard of:	
Hand-fed stamping presses	96,412
Abrasive wheels on stands	37,648
Engine lathes	36,058
Drill presses	20,426
Hand-fed circular wood saws ..	49,235
All other machines	169,341
All other working machine accidents	74,937

From the standpoint of accident prevention, the most striking and encouraging fact to be noted in the foregoing tables is the concentration of accidents about a few machines, since this portends a like concentration of effort in the elimination of danger through the efficient guarding of these few machines. Moreover, the guarding of these machines is simplified by the fact that it is the operator who is most often injured. Ninety-five per

cent of all machine accidents occur to the operators of the machines and of this ninety-five per cent, eighty per cent occur during ordinary operation as distinguished from other duties such as adjusting tools, repairing or inspecting, throwing the belt on or off and oiling or cleaning machines. It is apparent, therefore, that the guarding of working machines for the prevention of accidents means merely protecting the operators from specific known dangers incident to the ordinary operation of a few machines. It is indeed better to leave all the gears, all the belts and all the ordinary moving parts of mechanism unprotected if by so doing the protection of the specific hazard of stamping presses and circular saws alone can be accomplished.

Accidents due to the special hazard of these few working machines fall into three ⁶ principal classes, as follows:

- (1) Accidents from flying particles—emery and other abrasive wheels.
- (2) Accidents due to contact with the moving parts of machines—the knives of a jointer.
- (3) Accidents from kick-backs of work—the thrust of tongs holding a piece of metal which is struck by a steam hammer or the bar held at an alligator shear.

SPECIAL HAZARD ACCIDENTS

(1st Class.) The first class of accidents, the flying particle class, result not only from the flying metal cuttings which are very hot and sharp but include also abrasive materials and wood dust which is likely to be poisonous. Moreover, the metal particles are very apt to cause serious infections because of the germ laden lubricating oil used

⁶ There is a fourth group of Special Hazard Accidents consisting largely of burns. Dye kettles contain hot liquids with which the operators of these machines come in contact. Explosions of gasoline fumes remaining in laundry tumblers result in Special Hazard Accidents.

⁴ Planing mills and furniture manufacture.

⁵ Foundries, forging, sheet metal work, machine shops, ball bearing manufacture and the manufacture of fine machines and instruments.

on the machines. These flying particle accidents may be prevented in part by exhaust systems which are in common use in the woodworking industries, although not so frequently applied to jointers, shapers or circular saws. A large number of abrasive wheels have been provided with exhaust systems which are particularly efficient where the nature of the work performed on the wheel permits of a nearly complete enclosure. The difficulty lies in the fact that exhaust systems cannot readily be applied to a number of machines which are among the greatest sinners in the production of flying particles. Drill presses, lathes, milling machines, chip hammers and steam hammers all take a toll of eyes and cannot be successfully guarded by exhaust systems. The prevention of eye accidents in the operation of these machines must be by protection of the eye itself through the use of goggles.

Goggles, when worn, are unquestionably an efficient protection against flying particles. Workmen object to them, however, on the score that they are heavy, that the metal side pieces which fit against the face obscure the vision and that they are extremely irritating to the face in hot and dusty places. Doubtless also, the appearance of goggles is an objection to using them, since some types are almost grotesque. The omission of the side protection would reduce the efficiency of the goggle but little, since a great majority of eye accidents from flying particles are to the operator of the machine from which the flying particles are thrown and the glass barrier between his eyes and the machine stops nearly all of these particles. Goggles without the side piece are neither unsightly nor uncomfortable and they have an additional advantage in the ease with which a proper lens may be fitted for the use

of workmen whose eyes require special glasses, and who would thus need but one pair of glasses.

(2nd and 3rd Class.) The second and third classes of special hazard accidents must of necessity be considered together from the viewpoint of prevention. There are some fifty-six types of machines used in Pennsylvania factories having a distinct special hazard which can be readily protected. The following eighteen are the principal machines in their respective industries:

Meat Grinders
Pickers
Sewing Machines
Shears used in Textile Finishing
Centrifugal Extractors
Flat Work Ironers

Rubber Mills
Paper Calenders
Job Printing Presses
Paper Box Corner Stayers
Wood Shapers
Jointers

Hand-fed Circular Rip Saws
Blanking and Forming Presses
Abrasive Wheels
Pug Mills used in Brick Making
Fans and Blowers
Screw Conveyors

As a generality, it may be stated that automatic feeding is the most efficient protection for the workman who operates a special hazard machine, since he is removed by the very fact of automatic feeding from the point of danger. The disadvantage is that automatic feeding can be applied to machines only when work of the same sort is performed continuously. Safeguards have therefore been devised by machine builders and manufacturers and have been standardized by the discussions and the publications of scientific societies and of the Federal Bureau of Standards to such an extent that the public is now generally familiar with the subject. Briefly, the most efficient

of these guards are the ones which enclose the points of contact and are so securely fastened in place that they cannot be removed without a great deal of difficulty. This last requirement is particularly important—a one-time standard guard for a circular rip saw was lacking in efficiency because it could be set aside when the saw was to be used for grooving, an operation which should not have been performed on a rip saw. The present standard guard prevents such misuse of the saw.

An excellent example of standard guarding is the present guard for the circular rip saw, which consists of a hood for the saw attached to a riving knife at the rear of the saw. The riving knife is for the purpose of preventing the work from binding on the back of the saw. This binding occurs when the saw is dull or when it is working on green wood and has the effect of throwing the wood forward with great violence. The attachment of the hood to the riving knife not only supports the hood but also helps to prevent kick-backs such as occur when the wood binds. Since the hood is larger than the saw cut, the wood cannot rise far enough on the saw to be

thrown forward. The hood rests on the saw table in front of the saw and has an inclined lip at the front so that it is raised by the approaching work just enough to allow the work to pass under, but not far enough to permit the hands of the operator to come in contact with the saw. This guard thus prevents both the second and the third classes of special hazard accidents and is therefore highly efficient.

The very simplicity of this circular rip saw guard is an indication of the ease with which all so-called points of operation may be guarded. It is very much more difficult to prevent accidents from falls of persons and falling materials than it is to prevent mechanical accidents and there is therefore no excuse for the latter. The number of accidents due to the special hazards of machines has already decreased, even though many of the guards have been inefficient. With safeguards becoming more and more efficient and more standardized it is apparent that the importance of mechanical guarding is now very generally recognized and special hazard mechanical accidents should therefore decrease very rapidly in number.

Safety on Walkways, Floors, Etc.

By H. WEAVER MOWERY

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TO give proper consideration to a subject it is essential to appreciate its importance in relation to kindred matters. This is all the more necessary when incorrect ideas are prevalent. Therefore it seems desirable, in presenting the subject of walkway safety, to consider at the outset the relation of this phase not only in its connection with general safety work, but with other specific features.

When someone is burned to death in a fire or killed in a train wreck considerable attention is focused on the incident, but when someone is killed by slipping on a stairway or unsafe walkway surface, it is taken as a matter of course. There is nothing spectacular or thrilling in such an accident and though the person may be killed, the incident is passed over lightly and is blamed on the person's own carelessness, intoxication, or what not. However, the data that are now available clearly demonstrates the extreme seriousness of unsafe walkways. The number of casualties resulting from them is greater than from conflagrations, surface cars and machines all combined. Approximately one-fifth of all the casualties result from falls and nearly one-half of these are caused through unsafe walkway surfaces.

SOME ALARMING STATISTICS

For purposes of comparison, and so that this state of affairs may be appreciated, it should be noted that in less than ten years more of our people are killed by everyday accidental falls than our total killed (111,012¹) in all wars

¹ Figures compiled by Chief Statistician for Vital Statistics, Bureau of Census, Washington,

since the founding of the United States nearly 150 years ago.

According to the records of the Bureau of Vital Statistics at Washington, D. C., *the total killed by accidental falls* from 1910 to 1922 inclusive, annually reported from the registration area, exclusive of Hawaii, and comprising from 58.3 per cent of the total population in 1910 to 85.3 per cent of the total population in 1922, was 129,686 or an average of 9975 per year. On a basis of 100 per cent of the population of the United States, the yearly average is approximately 14,000, which totals considerably more for a ten-year period than our total killed in all our wars, both foreign and domestic, since the Revolutionary War. All "falls" are not caused by unsafe walkway surfaces but nearly half of them are from that source, or approximately 7000 per year.

If records are obtainable from a large center of population and are found classified carefully as to actual causes, we can compare the total for that large center with the total of the country and if the comparison holds, it is quite reasonable to assume that the different causes also are comparable. We must resort to this procedure to check the figures for those killed by unsafe walkway surfaces in the entire country,

D. C.; figures on World War from report of Adjutant General to Secretary of War; and on other wars from unpublished tables on file in Adjutant General's office, from records of Indian Wars by Francis B. Heitman; annual reports to office of Adjutant General, compilations in office of Surgeon General, and Part 1st, Surgical Volume, *Medical and Surgical History of War of the Rebellion*, Government Printing Office, 1875, covering all wars both domestic and foreign, excepting War of Revolution, in which the United States has engaged.

because there is no national classification for this specific cause. We find in both New York and Chicago very carefully compiled data in which there are classifications which unquestionably comprise the fatalities due almost ex-

entire country. At this rate there would be over 11,000 individual cases. Both the figures from Chicago and New York therefore indicate that, inasmuch as the total fatalities from falls check with the total given by the

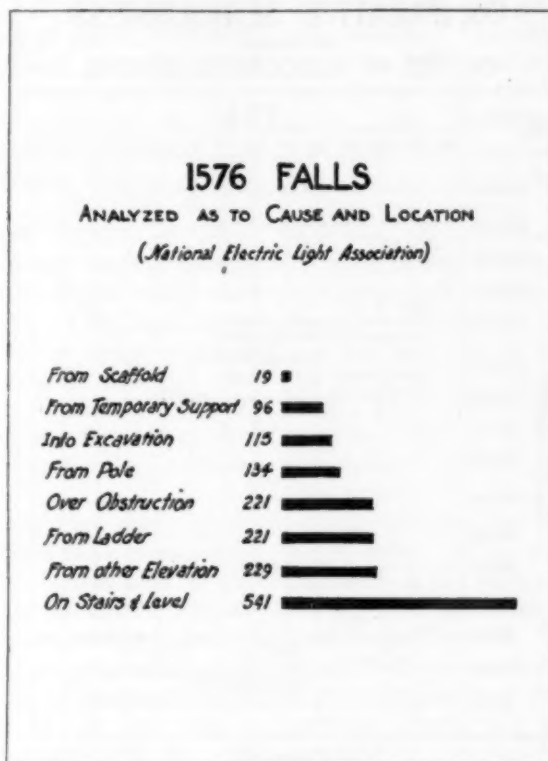


CHART I

clusively to unsafe walkway surfaces. In Chicago from 1910 to 1921 inclusive, there was a total of 4206 fatalities from falls, making an average of 350 per year. Chicago and Cook County having approximately one-forty-fifth (1/45) of the total population of the country, there would be, if the Chicago rate were maintained throughout, forty-five times 350, or a total of 15,750 annual fatalities from falls. In Greater New York from 1918 to 1923 inclusive, 4770 people were killed by falls. New York's population is one-twenty-second (1/22) of that of the

Bureau of Vital Statistics, it is safe to assume that the rate for specific kinds of falls will be approximately the same throughout the country as in those large parts for which we have accurate data.

In Chicago "On Floor," "On Stairs" and "On Street" contributed 1804 of the total of 4206 fatalities from falls in eleven years. In New York the average of fatalities from falls "On Floor," "On Stairs" and "On Street" per year was 327, while the total for all falls per year for the same period was 795. Both these sources indicate that nearly one-half of all the

falls are distinctly walkway surface casualties. Some of the other classifications, such as "Trains," "Street Cars," "Fire Escapes," "On Ship," "Porch," "Platform," and "Un-

accidents, which were included in a separate classification called "Over Obstruction." In this industrial classification it should be noted that there were relatively few stairways in the

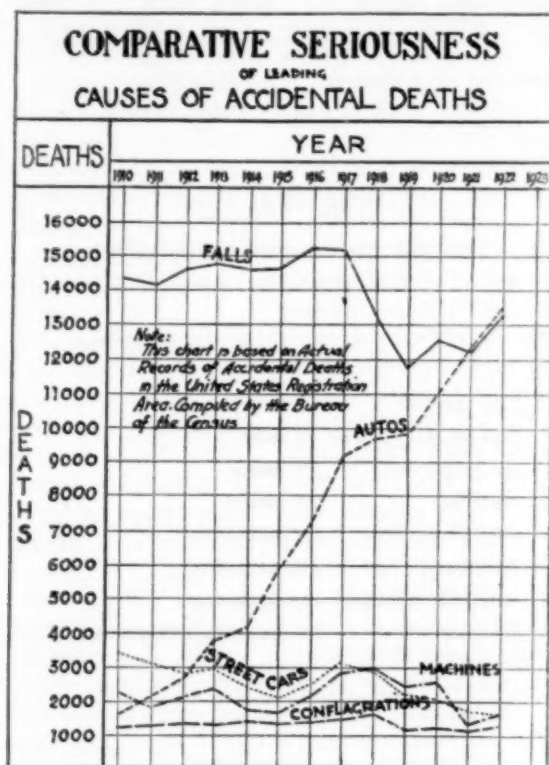


CHART II

known," may have included some fatalities directly caused by slipping; but inasmuch as nearly one-half of them occurred on stairs, floors and street, it seems to show beyond doubt the correctness of the formula,—"approximately one-half of all falls are caused by unsafe walkway surfaces."

The foregoing are public records. A consideration of industrial records leads to the same conclusion. A record of the casualties in 69 properties in 22 different states for a period of seven years showed that 38.6 per cent of their falls occurred on stairs and floor levels, not including any tripping

properties and their walkway surfaces usually are maintained in much better condition than the average.

In theaters, a large insurance company investigated 1531 accidents, of which number 1012 or 66.1 per cent were caused by falls. What percentage of the falls was actually due to unsafe walkway surfaces is not known. "Tripping" caused 23, or 1.5 per cent; "accidents to, from and on the stage" were 24, or 1.6 per cent; "accidents of a general nature" were 112 or 7.3 per cent; "falling objects" injured 172, or 11.2 per cent. But inasmuch as by far the greatest percentage was from falls,

and tripping accidents are considered separately, the same treatment also being given to accidents to, from and on the stage, it is safe to assume that unsafe walkway surfaces are a particularly important hazard in this class of building.

The seriousness of unsafe walkways from the standpoint of number of casualties no longer can be overlooked, but there are other features involved. The economic waste is very large. The *Ætna Life Insurance Company* paid \$14,319,438.99 on 146,782 claims. Falls contributed 33,360 of these claims, which is more than the usually expected one-fifth of the total, and cost \$2,318,337.04. Charging actual fatalities from falls on unsafe walkway surfaces at \$5000 each, and the non-fatal but serious casualties at \$150 each, the annual cost for this type of casualty would be in the neighborhood of \$100,000,000.

It is unfortunate that many safety engineers and others have been misled as to the relative seriousness of the different types of hazards. For instance, a report from a large industrial organization employing a safety engineer included a list of accidents for six months. Shown in the list were a number of slipping accidents, etc., and the report was concluded with the statement, "Not one of these accidents was due to a lack of protection by mechanical safeguards but to careless practice on the part of the workers." It is not fully realized that conditions can be made such that a person may pursue his normal activities without abnormal care and be safe. Surely slipping accidents would not occur if slipping hazards were not created or permitted to exist.

PROTECTION DUE THE PEDESTRIAN

There have been sporadic efforts to combat slipping hazards, both public and industrial, but there has been no

concerted movement. A review of what has been done and what can be done, pointing out the more common forms of these hazards and how they are prevented, will be helpful. In the first place, it must be appreciated that the slipping hazard gives no warning of its presence. The whirring belt or the noisy gear of themselves give warning, but not so with the slippery surface. Signs may be displayed such as "Watch Your Step," or "Be Careful," etc., but so long as the hazard is permitted to remain, accidents from slipping will continue. Therefore, if progress in this direction is to be made, the methods of providing safe walkways must be considered.

Various forms of tripping hazards are quite productive of accidents and they are so closely allied with walkway surfaces that we may include them. Projecting switch-throws on railroad properties, in yards of industrial plants and on electric lines in the streets of large cities are a common tripping hazard. A box flush with the walkway surface and containing the lever overcomes this hazard. Manhole covers, coalhole covers, cellar entrance doors, etc., should be flush with the walkway surface. Projecting hinges should be avoided by countersinking or placing on the under side. Tools, implements, and materials of all kinds should be properly racked or placed in such manner that they will not cause tripping. Gas and water valve cut-off boxes projecting above the surface of sidewalks constitute a common form of hazard which can be avoided. Occasionally the earth sinks and the surrounding surface should be leveled with the top of the box.

Unguarded sidewalk cellar entrances, areaways, excavations, etc., in or adjoining walkway places should be covered or guarded by railings or other means. In New York City all areaways, in the congested districts es-

pecially, have been covered with gratings. Sidewalk elevator lifts with automatic doors opening with guards in place have successfully overcome the hazards of the open and unguarded pit.

projections or depressions, not convex, and with an anti-slip surface; and shall be hooded on the underside in such manner that when open the hole is entirely protected leaving only suffi-

1222 LOST TIME ACCIDENTS

(MORE THAN ONE DAY BUT NOT FATAL)

ANALYZED AS TO CAUSE
(National Electric Light Association)

Lamp Breaking.....	71
Altercation.....	51
Injured by Animal.....	71
Overcome by Gas or Heat.....	81
Injured by doors or windows.....	131
Explosion Gas, Gasoline, Steam.....	181
Burns from Acid, Solder etc.....	221
Machinery in Motion.....	311
Colliding with obstructions.....	431
Foreign body in eye.....	511
Miscellaneous.....	621
Injured by nail etc.....	641
Vehicles, Autos etc.....	671
Electric Current.....	861
Falling body.....	1181
Handling Tools.....	1361
Handling Material.....	1971
Slipping, Tripping & Falling.....	2931

CHART III

In sidewalks, the coalhole or manhole cover as ordinarily used constitutes one of the most prolific sources of sidewalk casualties. A single cover furnished nine casualties in a single day, reported to one casualty insurance company. Not only slipping and tripping are involved in connection with the ordinary coalhole covers but numerous cases of falling into the hole while uncovered or when cover is removed for service have been reported. The best modern practice now requires that coalhole covers shall be flush with the surface without

cient space on the vertical face towards the curb for the insertion of the coal chute. Where old covers are in use a rail guard around it should be employed while coal is being unloaded. Such a guard should be as important a part of a coal wagon equipment as the shovel and chute, and should be made compulsory. If steel-bar construction is employed for such covers the distance between the bars should never be greater than one inch and they should be constructed to prevent spreading. Metal borders around vault lights are a vicious slipping hazard. In some cities

a heavy coat of asphalt is placed on such a surface. Neither of these methods is entirely satisfactory. Strips of safety tread with beveled edges may be applied to such a surface with good effect. To prevent slipping on the cement surface in which glass is located an abrasive grain is floated into the cement when setting.

Ramps or inclines should provide high frictional resistance. As the angle with the horizontal increases, the frictional resistance should be increased. When a granolithic finish is used, an abrasive should be floated into the surface before it takes its initial set. The Transit Commission of New York City for all such surfaces, and for train platforms as well, is requiring about one pound of 8/16 aluminum oxide abrasive per square foot. In numerous places strips of safety tread extending at right angles to the line of traffic and set in the cement flush with the surface are employed. It is important, however, that there should be no incline or ramp at the head or foot of a run of stairs.

PROPER TYPES OF WALKWAY SURFACES

Ordinary walkway surfaces such as corridors in public buildings, etc., are frequently laid in small tile, mosaic, marble, terrazzo, etc. Such materials should not be used for exterior sidewalks or in entrance corridors where people with wet or muddy shoes must traverse them. Some more suitable material having a higher frictional resistance should be employed at such locations. Terrazzo floors may now be obtained with a high degree of frictional resistance. A special product has been developed for use as a part of the aggregate which not only increases the durability of the floor but does not tear out during the grinding and polishing processes. All such materials, however, are much less hazardous

if properly cleansed. Soap powders should not be permitted as soap is a combination of grease and caustic and its use results in a film of grease filling the pores and covering the surface. A little moisture makes it dangerously slippery. The remedy is to use cleansing materials of the detergent nature in which there is no soap element.

There is some type of walkway surface material available which will give not only requisite durability but anti-slip quality as well, in almost every sort of walkway surface. Rubber, cork, travertine, asphalt mastic, granolithic, wood and steel all have their proper uses where they are entirely satisfactory, but care and judgment must be used as to what particular material shall be employed for a given purpose.

In woodworking and flour or cereal plants, in rubber manufacturing plants where powdered soapstone is used extensively, and kindred other places, the slipping hazard is particularly troublesome. Sawdust, shavings and other materials polish the floors and there is sufficient of this material which cannot be exhausted in the processes to make the hazard of slipping particularly acute. On the floors around power-driven machinery and in danger zones in general, such as elevator floor landings, boiler and machine room floors, building entrances, etc., an effective anti-slip surface should be employed. Numerous forms are available. Paint or glue with sanded surface has not proven at all satisfactory. While rubber is desirable around high tension switch boards, it is not so desirable where there is oil or water. Prepared roofing papers are sometimes used but they are lacking in durability and curl up at the edges, causing tripping hazards. Plates of abrasive metal or safety tread may be used advantageously.

THE DEADLY STAIR

Perhaps the most unsafe form of walkway surface is the stair. In designing stairways it is quite important that sufficient head room be obtained and the minimum distance or clearance measured from the top of tread on vertical line with face of riser to the soffit of the flight immediately above should be never less than seven feet. Doors or other entrances opening directly to stairs should be avoided. Landings large enough to provide standing room outside of space covered by swing of door, and glass panels in the doors when used at such locations are requisite for safety. Single runs of stairs or ladders should not exceed eight feet in the vertical. Treads on stairs should be of sufficient strength to bear the maximum number of people who can stand upon them and a safety factor of six should be used. The width of treads and height of riser must be constant for each run of stairs and the treads should be of sufficient width to allow ample space on each to place the whole length of the foot. Treads should not exceed 12 inches in width, including nosing overhang which should be from 7/8 inch to 1 1/4 inches. The nosing overhang is necessary to prevent the back of a shoe coming in contact with the riser and is particularly desirable in stairs used by women to prevent their skirts from being pinned between the heel and the riser. The angle of the stair should be between 30° and 36° and the best formula for determining riser height in inches is

$$\frac{25 \text{ inches} - \text{treadwidth}}{2} = \text{riser height}$$

But it is in connection with the type of material used for the treads that the greatest hazards occur. Wooden treads call for regular inspection and careful repair. Safety treads applied over wooden treads protect them

against wear when new and provide an easily replaceable insert if wear should be excessive. Concrete treads unquestionably should have safety tread inserts. The use of abrasive grain troweled into cement for this purpose has not proven satisfactory. The use of the safety tread in this instance is not only to prevent people from slipping but to protect the nosing edge from chipping and to take the wear on an easily replaceable insert.

The question of stair tread materials is so important that the laws of several states and cities contain provisions requiring that "The treads shall be so constructed and maintained that persons walking thereon will not slip." However, this provision has not proven sufficiently specific. There is a great variety of opinion as to what constitutes satisfactory materials for different locations that will provide the necessary frictional resistance to prevent people from slipping.

WORK ON SAFETY CODE

The American Institute of Architects and the American Society of Safety Engineers were designated by the American Engineering Standards Committee as joint sponsors for a "Safety Code on Walkway Surfaces" and work on the preparation of such a code has been progressing for several years. A considerable portion of the time has been expended in exhaustive researches by the Bureau of Standards at Washington. These researches have about been completed and a tentative draft of the code will be available in the near future. This code will deal with requirements for all those surfaces on which people walk and work who have had no representation in their care or maintenance. It is believed that the general adoption of the provisions required by such a code will do a great deal in helping to provide walkway safety in the future.

Eye Protection

By WALTER G. KING

Director of Safety Division, American Optical Company, New York City

PERHAPS there is no phase of industrial accident prevention work that stands out more prominently in the lists of both permanent partial and temporary total and permanent total disability injuries, than those resulting to the eye. It is fair to assume that there is hardly a single industry in our national industrial classification that does not have within its area an eye hazard of some description. On a more detailed study of this classification, one is confronted in many instances with the facts setting forth the major number of temporary disabling accidents and the great proportion of permanent partial and total disabilities resulting in the loss of one or both eyes.

A fair indication of this fact is reflected through Chart I, briefly showing the percentage of workmen's compensation awards for eye injuries sustained in sixteen industries in the state of Pennsylvania in one year's time. This same chart represents an expenditure through these compensation awards for these injuries of \$1,008,898. This expenditure may be still further increased when consideration is given to the factors of hospital, medical expense and labor turn-over cost, not neglecting the consideration of the pertinent factor of the economic effect of these injuries socially upon the worker and his dependents, a factor often hard to determine but one of a potent nature, perhaps more so than any one of those results that are accurately ascertained in the cost sheet of management.

ANALYZING ACCIDENT RECORDS

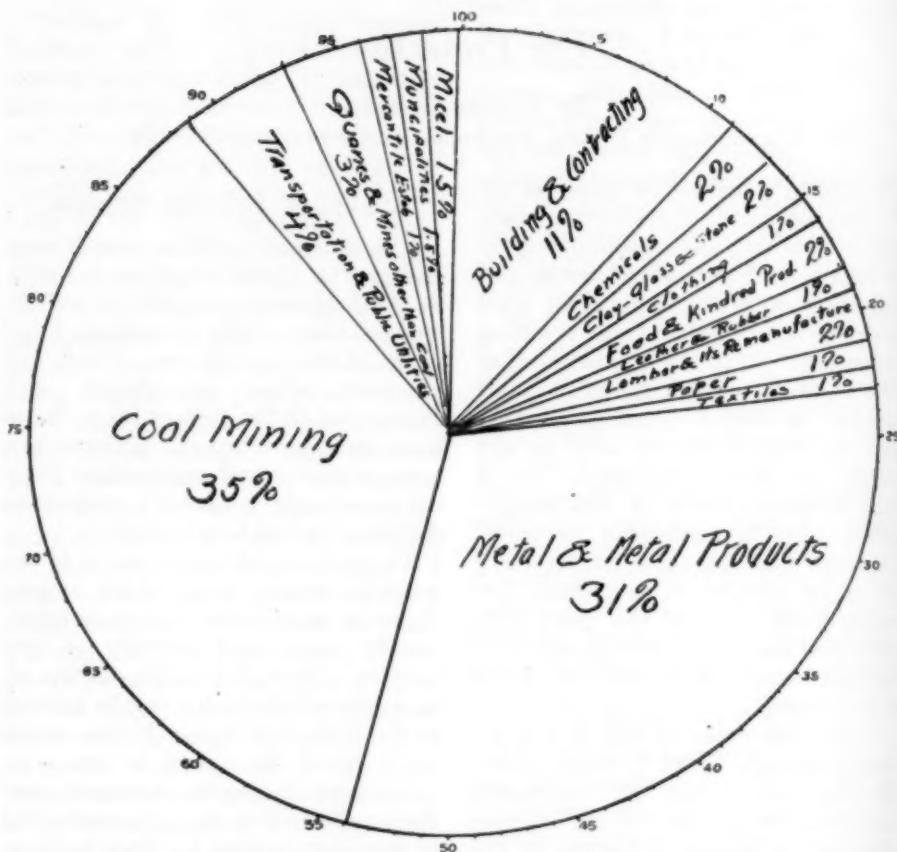
A consideration of these details may lead one to decide what can actually be obtained as an economic as well as humanitarian result in curtailing injuries of this description. Cases are numerous where curtailment and elimination of the type of injury have been obtained when the problem has been analyzed and approached from the same angle as one of a production deficiency would be attacked.

The first consideration is that of the accident records from which a conclusion is arrived covering the number, specific cause and severity of eye injuries. Chart II is an illustration of, on a general plan, what can be applied to the individual case. It also serves to illustrate the nature of these injuries from the causes sustained, producing effects that should be converted to economic factors for their application to the general plant production scheme.

From analyses of this type, including eye accident cost, production losses, etc., plant executive orders covering the use of eye-protection devices may be drafted. The endeavor to reduce a cost of this nature should receive the assistance of the highest operating officials and should be emphasized through orders for their initiation. This will aid in coördinating the efforts of the lower line division and department heads in their individual handling of the problem.

Executive orders of this nature can only be applied practically when,

CHART I



Percent Distribution of Compensation Awarded
in 1924 for
Eyes Lost Based on Industrial Classification,
Penna.

through the efforts of the safety department, the devices provided are of a design adequately to take care of the hazards with the least possible discomfort to the wearer. The National Safety Code for the Protection of the Heads and Eyes of Industrial Workers has classified protection devices as follows:

(A) Protection for chippers, riveters, caulkers, or against trades or jobs having a severe impact hazard.

(B) Protection for scaling, grinding, etc., or where the impact is of a lesser nature.

(C) Protection for exposure to dust and wind, or where the severity of impact is low and the efficiency of the device is its ability to protect the eyes from small particles of floating material.

(D) Protection for babbitting, etc., or where there exists an impact hazard of a major degree combined with that of a liquid in the form of molten metal.

(E) Protection for handling corrosive chemicals, dipping, brush coating, etc.,

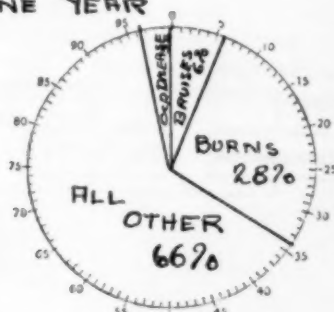
CHART II



DISTRIBUTION IN PERCENT OF CAUSES THRU WHICH EYES WERE LOST IN PERIOD OF ONE YEAR



ONE EYE



TWO EYES

TEMPORARY TOTAL DISABILITY CLASSIFICATIONS MASS.

in which elimination of liquid is to be considered from the angle of splash and atmospheric saturation.

(F) Protection for sandblasting in which a high impact hazard of small particles is combined with an atmospheric saturation.

(G) Protection for exposure to glare, or the elimination of both the annoyance glare created through the intensity of the visible band of the spectrum and the absorption of the injurious invisible rays.

(H) Protection for oxy-acetylene and electric welding operations, or those designed to protect through complete isolation from the transmission of the intense injurious invisible rays, particularly as applied to electric welding operations.

In each of these sub-divisions, based on the specific nature of the hazard, a particular device of an efficient design can and should be applied. The failure encountered frequently in the effective control of industrial eye accidents is due often to the lack of appreciation and consideration of factors of this nature by those charged with the promotion of the work. The result is often that objection of a justifiable nature applied to the use of the protectors by the employes is encountered, which, if not met and intelligently adjusted, invariably leads to a breakdown in the plan applied.

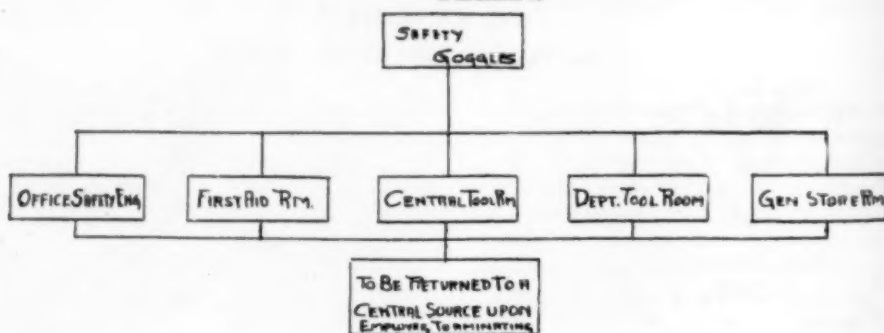
Upon determination of the efficient devices for the hazards involved and through the introduction of executive orders covering their use, combined with the co-operating assistance of division and department heads, the practical application of eye protection may be instituted.

From consideration of the above detailed classification of devices for recognized hazards, it is fair to assume that the same measure of efficiency should be applied in adopting these devices to the working force.

ADEQUATE PROTECTION DEVICES

The accompanying chart details a few of the most effective sources for the distribution and intelligent handling of eye-protection devices. Relative to each of these sources of supply the safety engineer should emphasize the necessity for having the goggles handled by some one familiar with their use. This person should appreciate what constitutes a fitted goggle so that the wearer may, in addition to obtaining protection from the eye hazard he is compelled to encounter, be given the assurance of a feeling of security behind the devices. These factors are determined by individual attention

DIAGRAM A



METHODS OF SAFETY GOGGLE DISTRIBUTION

on the part of the supply clerk and the quality of the material provided to take care of the specific condition.

A cheap spectacle lens in a light frame will not offset the impact of a flying piece of steel, stone or concrete, nor will an injurious ray be absorbed through the composition of a common sun glass of a varied hue. These are elements in themselves that unless considered will invariably break down the most conscientious efforts in plans to reduce eye injuries.

As indicated by this same chart, goggles may be handled as a tool or any other device in the plant and placed on a control or check basis. It is therefore advisable to give them the same consideration from the phase of upkeep and repair that a tool would receive. For isn't their mission of a higher nature in most instances than the most expensive tool, when consideration of their use is measured as an economic factor of operation, combined invariably with their control from a social and monetary loss entailed through their lack or misuse? Therefore, a goggle should be thoroughly sterilized and reconditioned before being put in service again. One of the most destructive factors in the failure of effective eye-protection methods is the use of the general goggle, hung on a nail in a remote section of the shop and used by anyone for all purposes. This practice is a virulent source of not only an eye accident but disease and is comparable only to the common drinking cup and

roller towel long since relegated to the scrap heap of unsanitary practices.

Supplementing the introduction of efficient eye-protection devices, bulletins may be used detailing specific eye hazards, rules covering the use of goggles and places in the plant or on the job where they may be obtained.

Through the efforts of the safety department, in conjunction with its plan of publicity, consideration should be given to acquainting departments, foremen and safety committee men with the appreciation of eye hazards and methods instituted to offset them. Efforts of this nature will invariably assist in offsetting at the source minor complaints that may be encountered through the objections of the individual worker, all of which when properly handled through subordinates, familiarized with the important details of the problem of industrial eye protection, will assist materially in its successful execution.

Industrial eye protection cannot be handled as an inconsequential side issue, or a necessary evil to be tolerated by industry and anticipation of successful results obtained, but where its importance from a production and economic cost factor is recognized and efficient application of good management methods applied, it will be a most effective force in combining increased production with definitely lowered operating costs. Both obtained with a monetary expenditure and organization effort of a surprisingly limited volume.

Guarding Against Infection

By W. IRVING CLARK, M.D.

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INFECTION is a word used by the medical profession to describe the implantation in the tissues of the body of minute, living, harmful organisms known as bacteria in such a way as to favor their growth and to permit their poisons to injure the tissues. From this it will be seen that an infection may be a contagious disease, such as influenza or typhoid fever, or it may be an infection caused by one of the pus-forming bacteria giving rise to what is commonly known as "blood poison," the correct name of which is septicemia. The latter form of infection is the only one which will be discussed in this article.

The human body presents a protective wall of skin which completely excludes all bacteria from becoming implanted in the tissues of the body, provided this barrier of skin is unbroken. The break, however, need only be of the most minute size to afford a passage for bacteria into the tissues immediately beneath the skin surface. These tissues contain channels through which a fluid, known as lymph, circulates, and because of this it is possible for the invading bacteria themselves, or the poisons which they produce, to be carried to other parts of the body.

HOW THE BODY FIGHTS DISEASE

When bacteria enter the body they multiply with great rapidity and produce poisons which have both a local and general effect. The local effect of these poisons is known as inflammation and shows itself by the production of heat, redness, swelling and pain at the point at which the bacteria are lodged.

The reaction of the body to this infection by the pus-forming bacteria is a slowing of the blood current in the immediate vicinity of the site of infection, and a pouring out of white blood cells into the affected area.

The blood contains two types of cell, the red blood cell and the white blood cell. The white blood cell has for its particular function the destruction of pus-forming bacteria. This it does by absorbing them into its structure and there destroying them. The bacteria, however, by their poisons (toxins) cause the death of many of these white cells, and the result of the conflict is a localized collection of what is called pus, which really is a combination of dead tissue, bacteria, and dead white blood cells in semi-fluid form. As long as the inflammation remains near the point of entrance of the bacteria the infection is said to be localized. Very frequently, however, as was stated before, the bacteria and toxins are carried by the small lymph vessels to other parts of the body. The lymph vessels are very minute vessels which form a network in the tissues beneath the skin, these fine vessels being collected into larger trunks which pass beneath the skin towards groups of glands known as lymphatic glands. These lymphatic glands act as filters and prevent the bacteria from entering into the blood stream into which the lymphatics finally flow. When the lymphatics are involved in the infection, the condition commonly known as "blood poisoning" is taking place. In spite of the filter action of the lymphatic glands a certain amount of toxin is absorbed by the

blood, and the body as a whole reacts by temperature and other signs, beginning the symptom complex known as fever.

From the above description it will be seen how important it is to prevent bacteria from getting a foothold in the tissues of the body. Inasmuch as it is impossible to prevent the breaking of the skin and as this occurs in the majority of accidents of any severity, the problem is how to prevent the bacteria, which are implanted, from setting up a definite focus of infection. In case of any injury in which the skin is broken, the body makes an effort to defend itself by pouring out blood and lymph which has a tendency to wash out any bacteria which are introduced into the wound, and, secondly, by sending an increased number of white blood cells to the injured point. These attack any bacteria which have been introduced at a very early stage. If, however, the bacteria which are introduced are of a virulent type, the effort of the body is insufficient.

GUARDING AGAINST INFECTION

The problem of guarding against infection such as has just been described may be divided into four parts:

- (1) The problem of how to keep the number of pus-forming bacteria on the skin as low as possible.
- (2) How to keep the pus-forming bacteria from the substances with which the worker comes in contact.
- (3) How to keep the resisting power of the worker at high efficiency.
- (4) When a wound occurs how to remove and kill as many invading bacteria as possible.

The best method of keeping the number of pus-forming bacteria on the

skin as low as possible is by the frequent use of soap, a scrubbing brush and hot water. Surgeons use this method in preference to all others as a preliminary to operation. It is believed that the majority of the bacteria can be removed from the hands in this way. Therefore, the worker should be urged to wash his hands as frequently as possible, taking time, plenty of hot water and a medium stiff brush. This is particularly indicated when the substances with which the worker comes in contact are known to contain pus-forming bacteria. This is frequently the case on the machines in which grease and cutting oils are used. Sunlight kills pus-forming bacteria with great rapidity. Therefore, open-air sports and exposure of the hands to the sunshine when it is possible, are of some help.

The factory owes it to its employees to keep pus-forming bacteria from the substances with which the worker comes in contact. This is at times very difficult. Cutting oils, as mentioned above, appear to be particularly prone to bacterial infection. This is also true of animal and vegetable oils and greases. The only sure way of sterilizing oils and greases is by boiling them. It is usually found that infected oil has been contaminated by contact with some one who has an infection, the oil being used over and over again. Thus at the author's factory a man was found to have several boils on the arm which followed minute abrasions caused by steel chips breaking the skin, a secondary infection resulting from the oil of the man's machine. A culture of this oil showed large quantities of pus-forming bacteria. The oil was removed from the machine, the machine cleaned with caustic soda and fresh oil introduced. The man was kept from the machine until cured. No other man developed infection who

used this machine, showing that the sterilization had been satisfactory. A factory in which large numbers of boils appear around the worker's hands and arms should investigate the condition of its oils, and see whether infection cannot be immediately stopped by proper care.

In spite of every precaution, pus-forming bacteria in small quantities are to be found on almost every skin and in a number of substances with which the worker comes in contact daily in his work. If these bacteria are virulent, or if the resisting power of the worker is low, infection is bound to occur if the bacteria gain an entrance into the tissues. For this reason it is of considerable importance that the resisting power of the individuals be kept as high as possible. There is no formula which will produce this happy result. So many forces are at work that it is difficult to say what gives one man a high resisting power and another a low resisting power. It is, however, a general rule that men who are in good physical condition have less chance of their wounds becoming infected than those who are in poor physical condition. Men who have diabetes are particularly prone to infection, and any man who shows repeated infection should have his urine examined to determine whether or not he has this disease. A number of men in every factory, while not diabetic, may be in what is known as the pre-diabetic stage, in which there is a high content of sugar in the blood without any actual elimination of the sugar in the urine. These cases appear to be more prone to infection than those with a low blood sugar.

The most important method of guarding against infection when a wound occurs is to remove and to kill as many of the invading bacteria as possible, and to prevent any additional bacteria from gaining access to the in-

jured part. In considering this method the element of time is of the utmost importance. The longer the period which elapses between the time that the injury is received and the time that it receives proper treatment, the greater the chance of infection taking place. This is because the bacteria which, at first, are only lightly affixed to the tissues, in a very short time become firmly attached and carried to deeper parts by the lymphatics.

The first principle, therefore, is to have the wound treated as soon as possible following the injury. The proper treatment in a moderately severe wound should, however, always be administered by a doctor, and it is wiser for the untrained worker to merely stop the flow of blood and prevent further contamination of the wound than it is for him to attempt to treat the wound himself, or to submit to its treatment by one of his friends. First aid, therefore, should consist merely in the stopping of a severe flow of blood and the application of a dry sterile dressing to the wound with immediate transportation to the nearest trained medical help.

In severe injuries infection is guarded against by removing all foreign matter from the wound. This is done by a surgeon, the patient being under an anesthetic. First, all tissue which has been apparently killed by the force of the injury is cut away. This removes not only the dead tissue, but also the bacteria which are embedded in it, and leaves a comparatively clean wound. This wound is then cleaned by alcohol, ether, benzine and Tr. Iodine.

In smaller or less severe wounds the removal of dead tissue is usually not necessary, and the wound is cleaned thoroughly, inside and outside, by the use of U. S. P. Tr. Iodine, in either full or one-half strength. Inasmuch as bacteria lie on the skin surrounding

the wound, cleaning and sterilization of the surface for a considerable distance around the wound is always done.

If the wound is at all severe the injured part should be put at rest by a splint, providing the injury is to one of the extremities.

ANTISEPTICS—WHAT AND HOW TO USE

To the layman the application of the antiseptic always appears to be the important thing in guarding against an infection. To the doctor the removal of dead tissue and a thorough cleansing of the wound and skin is far more important. Of antiseptics there are a host in use. Most industrial surgeons now confine themselves to one of three.

(1) Tr. Iodine, which always must be preceded by benzine or gasoline and never by soap and water.

(2) Mercurochrome two per cent. Where the wound is very painful this antiseptic is used. This should also be preceded by benzine or gasoline cleansing.

(3) One of the chlorine substances such as Dakin's Solution or Dichloramin T. If Dakin's Solution or Dichloramin T are used, whatever the preceding cleansing, alcohol followed by ether should precede the application.

Dakin's Solution is applied wet directly into and over the wound with a medicine dropper, or by special rubber tube. Dichloramin T is applied by dropper or glass spray. No metal should touch either Dichloramin T or Dakin's Solution in applying them to the injured part.

After the wound has been treated with an antiseptic the usual method

followed, except when Dakin's Solution is used, is the application of a dry pad of sterile gauze which covers not only the wound but the entire area surrounding the wound. This pad is held in place by a gauze bandage which need not be sterile.

If Dakin's Solution is used the pad is saturated with this solution, the patient is given a small bottle of it with a medicine dropper, and instructed to keep the dressing moist between visits to the dispensary. As Dakin's Solution is an irritant to the skin, the area around the wound is covered with sterile vaseline.

To sum up, clean, healthy workers, who receive prompt, efficient, medical treatment, within one-half hour of the time of their injury, seldom develop any infection in the wound. In the author's factory an analysis of the last 2500 cases shows infection in but one-half of one per cent, and in these cases the men had not applied for treatment until twenty-four hours or more had elapsed from receipt of the injury. In no case was there an infection when the man had applied promptly for treatment and had not meddled with his dressing himself. One of the large railroads has the same record—one-half of one per cent of all wounds becoming infected. Six very large factories varying in product from rubber goods to ship building reported a total of only 189 infections in 215,144 wounds, a most remarkable record of the present efficiency in guarding against infection.

The Prevention of Industrial Poisoning

By WILLIAM F. BOOS, M.D.

Toxicologist, Boston, Mass.

THE constant and rapid increase in the manufacture of chemicals and dyes, since the World War, has brought with it many hazards which before were comparatively little known in the United States. As a result, dangerous solvents and reagents and noxious products of chemical reaction, with which many of the manufacturers are not familiar, have caused loss of health and life in these industries. Then too, new methods of manufacture, which are coming into vogue more and more in other trades, are also introducing new elements of danger to the employe.

The chemical poisons which demand our attention are many. With some of them we are becoming more familiar, but there are still quite a number which will have to be studied carefully and in detail before we are in a position to cope successfully with their dangerous qualities. In this paper I shall touch, in a general way, on certain industrial poisons which are widely used, and I shall endeavor to suggest some of the ways and means to combat them.

BENZOL POISONING

One of the commonest substances in use in the chemical and rubber trades is benzol. For many purposes this is, without doubt, the best solvent available, but it is so very dangerous to the employes who use it, that other, less noxious solvents must be found to replace it.

Benzol produces both acute and chronic poisoning. The acute cases may be so rapid in development that it is often too late to save the victim

when the true nature of the poisoning is recognized. In most instances benzol enters the system through inhalation; but the sense of smell is not a reliable guide to the degree of toxicity of a given benzol atmosphere because the percentage of its vapor, which may be dangerous, is so low that the worker frequently does not become aware of the fact that he is inhaling a toxic amount until he shows the signs and symptoms of chronic benzol poisoning, a condition which is most serious, since it leads to invalidism and death.

The dangerous character of benzol has caused a search to be made for substitutes, and one of the papers presented at the recent congress of the National Safety Council dealt quite in detail with one of them. It is a mixture of high-boiling, aromatic hydrocarbons containing toluol, the xylols, etc. Such a mixture is so slightly volatile that, at ordinary temperatures, the respired air contains only minimal amounts, and the compounds themselves are comparatively so innocuous that even when an increased percentage of the solvent is present in the air, owing to higher working temperatures or more violent chemical reaction, the danger of poisoning is not great. The use of such a solvent entails much less loss from evaporation, and is therefore commercially more advantageous than the use of benzol. Perhaps this feature will recommend it to many manufacturers who are still using benzol. Its advantages from a safety point of view are so decided that it is to be hoped that all users of benzol will give the new solvent their immediate attention.

CARBON BISULPHIDE POISONING

Another solvent, used particularly in the rubber trades, which is very poisonous, is carbon bisulphide. Experiments are in progress with possible substitutes, among which carbon tetrachloride seems to have the preference. This substance is by no means non-toxic, but it is so much less poisonous than carbon bisulphide that its substitution for the bisulphide will be a step forward.

POISONING FROM NITROUS FUMES

Nitrous fumes, the product of the reaction of nitric acid with reducing agents, such as metals or organic compounds, form a great hazard in the chemical and dye industries. These fumes should be guarded against by the installation of efficient exhaust systems in all places where nitrating or diazotizing is carried out. If a worker is gassed or is overcome by the fumes, he must be made to inhale diluted ammonia gas immediately. This will prevent the very serious consequences which often occur later in untreated cases, nitrous fume poisoning being the most insidious form of industrial intoxication known. The nitrous fume hazard requires constant watchfulness and careful attention to all cases of exposure, because some of the seemingly mild cases often result fatally if they do not receive the ammonia treatment at the start.

TURPENTINE POISONING

Turpentine poisoning has become more common of late because of the methods of spraying paints and varnishes which are coming more and more into use in the automobile-body and furniture industries. It can be guarded against by the use of spraying booths provided with efficient exhausts. The installation of a general exhaust system in the varnish or paint shop is not ad-

visable, because it creates currents of air which tend to disseminate the turpentine vapors throughout the room.

Chronic turpentine poisoning is very serious in its effect on the kidneys. Many employes who fall victim to it, recover only very slowly, and some remain chronically disabled. The signs and symptoms of the trouble are often, moreover, very much like those of lead poisoning, and therefore most cases of chronic turpentine poisoning go unrecognized. But the treatment of the turpentine cases is materially different from that of lead poisoning. It is therefore very essential that the two kinds of poisoning be carefully differentiated.

POISONING FROM LEAD USES

The spraying of lead paints is also very much on the increase, so that there is to-day perhaps a greater lead hazard, particularly in the automobile-body manufacture, than there ever was before.

In the case of lead spraying, too, a booth is necessary, and this booth must be provided with a *downward* exhaust, to assist the heavy particles of lead paint to settle toward the floor. Any other kind of exhaust would tend to keep the lead paint particles suspended in the air, and it is therefore out of place. The men who do the spraying should wear a gauze mask covering the nose and mouth.

Where booths are in use it is often the practice to have an employe scrape together the paint which was sprayed on the sides of the booth. The workman doing this job is apt to think that because he is not spraying, he does not need a mask. But the scraping up of dried lead paint is the most dangerous occupation of the trade. In order to reduce the hazard to a minimum, the paint should be moistened by a fine spray of water, and then be scraped up

in the moist state. This, of course, applies also to black, gray and white lead enamels, such as are sprayed on range parts and kitchen utensils.

Putty makers should wear gauze masks if they have to work with dry, white lead. But the danger of lead inhalation is avoided if the employer buys his white lead in hundred-pound cans, under oil.

Although lead is probably not absorbed from the unbroken skin of the palms, it is nevertheless wiser for putty mixers to allow the putty to come in contact with their hands as little as possible during the mixing process. The same caution applies, of course, to the employes who putty the automobile bodies after the first coat of lead.

All sanding of lead paint should be done wet, and the men who do the sandpapering of putty patches or paint, should wear gauze masks. The sandpapering hazard is greatly reduced if the automobile bodies which are to be sandpapered, are placed over a grid with a downward exhaust.

All employes who work in any way with lead paint should be compelled to wash and scrub their hands, and clean their finger nails before they eat their luncheon and before they go home for the day. The chewing of tobacco should be forbidden, because it is impossible to prevent lead paint from getting on the plug when it is handled by a painter during his work.

CHROME POISONING

Chrome poisoning occurs very frequently in chemical works where chrome compounds are prepared. The inhalation of the dust causes ulceration of the mucous membrane of the nose and at times even perforation of the septum. Therefore all employes whose work brings them in contact

with chrome dust must wear gauze masks. If, in spite of the mask, they feel the itching and burning effect of chrome dust on the mucous membrane of the nose, they should be made to spray the nose promptly with a ten per cent solution of "hypo" (sodium thiosulphate) in an atomizer. Chrome solutions spattered on any part of the employe's body should also be neutralized at once with hypo solution.

These precautions apply, of course, also to the chrome tanning trade. The men who take the skins from the chrome bath should wash their hands, arms and perhaps even their face in the hypo solution before they go home at night. Since it takes the chromic acid some time to penetrate the skin, this procedure will effectually prevent the occurrence of chrome burns or chrome rashes.

TWO HEADS WISER THAN ONE

The important point to remember in connection with all industrial poisons is that prompt neutralization or removal of the poison amount really to prevention, because the bad cases are usually simply neglected ones. The physician in charge of the plant should therefore familiarize himself as much as possible with the reagents necessary to neutralize the action of any toxic substances which the employes handle. But it is often a question of several heads being wiser than one. If the doctor is not familiar with the character of the poison affecting one of the employes, he should consult with the chemist who can give him the information needed; then the doctor can bring about recovery from the injury in an intelligent manner. Each one alone is unprepared to cope with the problem, but working together they attain efficiency.

Industrial Lighting as a Safety Measure

By JOHN S. SPICER

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A RECENT publication, sent out by the Industrial Lighting Committee of the National Electric Light Association, sets forth the result of a survey which was made of 390 industrial establishments for the purpose of ascertaining what conditions existed in the average plant with respect to lighting facilities. This report states that of the 390 establishments surveyed 56 per cent were found to be poorly lighted, 29 per cent fairly lighted, and 15 per cent well lighted. It is believed that this survey is fairly representative of conditions as they now exist in industry. It has been my privilege to observe conditions in hundreds of plants over a period of ten years; and from this experience I, too, can bear testimony to the fact that my observations have revealed an equal percentage of plants wherein the lighting facilities were inadequate. If it can be proved that inadequate lighting is responsible for a considerable number of the accidents which are occurring annually, then surely consideration of illumination must have a large part in any program which is undertaken for accident prevention.

Investigation of accidents and review of accident statistics seem to prove conclusively that there is a distinct relation between illumination and the occurrence of accidents. Some years ago R. E. Simpson, illuminating engineer of the 'Travelers' Insurance Company, made a study of 91,000 industrial accidents. This study revealed that 10 per cent of those accidents were due primarily to in-

adequate illumination, and 13.8 per cent had, as a contributory cause, the lack of proper lighting facilities. Ten years later Mr. Simpson made a similar investigation and at that time reported that instead of 23.8 per cent of the accidents being traced to inadequate illumination, only 15 per cent could be attributed directly or indirectly to inadequate or improper illumination. During this ten-year period enormous strides were made in the art of illumination, and it seemed proper to consider this reduction in the number of accidents, attributed to faulty illumination, to be due to the direct result of the efforts which were put forth by industrial managers to improve lighting conditions. Some years ago statisticians reported that the largest percentage of accidents occurred during the winter months and during the portions of the day when it was necessary to use artificial illumination, if such illumination were available.

A recent study of over 650,000 industrial accidents reported to the Pennsylvania Department of Labor and Industry, for the years 1921 to 1924 inclusive, shows that 24,000 more occurred during the winter months than during the so-called summer months when there is a relatively smaller number of hours of darkness. Four hundred more fatal accidents occurred during the same period.¹ The months of October, November, December, January, February and March have a relatively larger number of

¹ See Figs. 1, 2.

hours of darkness than hours of daylight, and it is during these winter months that the accident records show 24,000 more accidents to have occurred. While these figures do not represent

In other words, the year 1924, insofar as the reported industrial accidents of Pennsylvania are concerned, shows a more uniform monthly average than in the year 1918 or earlier. In this

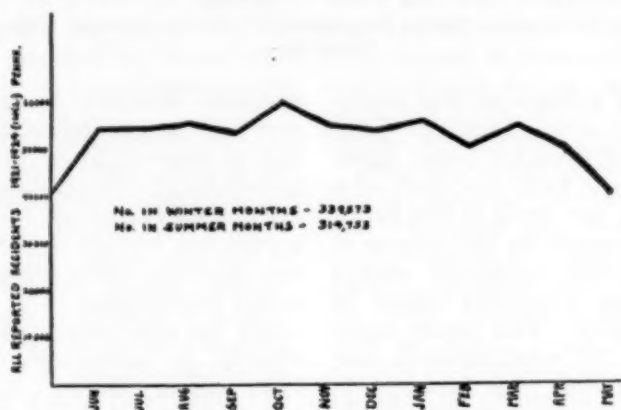


FIGURE 1.—It is interesting if not significant that many more accidents occurred in the winter months than in the summer months.



FIGURE 2.—Fatal accidents occur more frequently during the winter months.

actual accident rates, they can be accepted as showing the relative trend of industrial accidents, insofar as they have been reported by employers in the state of Pennsylvania. Over a period of ten years there was apparently a gradual lowering of the peak of accidents during the winter months as compared with the summer months.

latter year there seemed to be a decided increase in the number of accidents reported during the winter months. It is believed that this equalization has been brought about by the fact that illumination in industry has been improving so rapidly during the last ten years that conditions during the winter months under

artificial illumination are more equal to conditions found during the summer months when artificial illumination is not necessary. This is purely a deduction based on relative factors and cannot be stated as an absolute fact.

Various authorities have from time to time made studies in industrial establishments of the results which can be obtained through the use of proper illumination of the right quality and intensity. Such tests have shown that production can be stimulated, spoilage can be reduced, and the number of accidents materially lessened. If in the establishment where average conditions exist a study is made of the illumination needed for particular kinds of work, and an adequate system based on this study is installed, production will be increased 15 per cent or more, there will be 25 per cent less spoilage of product, and at least 25 per cent of the accidents will be eliminated. In the last five years I have come in contact with such experiments and accordingly feel sure that such a statement is not an exaggeration, but that it indicates the possibilities of what can be accomplished. For this reason it may be authoritatively stated that there is a distinct relation between illumination and the number of accidents which occur, and that if the illumination were improved, there would be a decrease in the number of accidents.

At the present time there seem to be three types of illumination which are found in industrial establishments. They can be classed as follows: inadequate, improper and adequate illumination.

INADEQUATE ILLUMINATION

Under the heading, "Inadequate Illumination," there might be grouped those plants where no attention has been given to the amount of light

necessary for the work which is to be done. As a result the employees are unable to discern objects clearly or to observe details. The effort which they must put forth to see under such conditions induces eye fatigue with the possible result of eye impairment. Such conditions not only are prolific of accidents, but they produce in employees a feeling of discontentment with its attendant evils. This is apparent even under superficial investigation. Several accidents might be cited: In the first case the investigator attributed the cause of the accident directly to insufficient illumination. The report stated that about midnight an engine was backing down a track. On the adjoining track a locomotive crane was working with a grab-shell dirt bucket. The crane operator did not notice the engine backing down the other track and while he was swinging the bucket around it crashed into the cab of the locomotive. The fireman was crushed to death. Both the engineer of the engine and the operator of the crane stated that the accident could have been avoided if there had been sufficient light for each to see the other. Many cases occur from a similar cause, but the fact is not recorded by those making the investigations. This instance recalls another fatal accident case which occurred in a railroad yard. A railroad employe was killed by being run over by a draft of cars which he had not noticed, owing to the meager amount of illumination in the railroad yard at that time. Another employe, a member of a safety committee, made a statement that he attributed the accident to the cause of insufficient illumination and recommended that additional lights be installed in that yard. The matter was referred to the proper authorities, and an inspector was sent to make an investigation to

determine if additional lights were needed. He reported to those in authority that in his judgment no additional light was required. There were some features of the report which led the authorities to believe that proper consideration had not been given by the inspector to the matter, and accordingly a further investigation was ordered. It developed later that the inspector who had been sent out to determine if additional lights were necessary made his inspection in the day time and based his conclusion upon his visit to the yard at that time. Manifestly it would be impossible to determine by an investigation in the day time whether additional lights were necessary at night. Before the matter was finally settled it was decided that additional lights were necessary in that yard. They were installed and have been quite helpful in preventing accidents of a similar nature.

Possibly the best experiment which can be used to illustrate the fact that inadequate illumination is a hindrance to production and safety can be shown by the use of the device pictured in Figure 3. In this experiment a revolving cylinder is used upon which is printed various sizes of printed letters. As this cylinder is revolved at a uniform rate of speed, light of varying intensity is directed upon the cylinder. With the lowest intensity of, for example, three foot candles, it is possible to read the largest letters, but as the intensity is increased the cylinder not only seems to revolve more slowly, but the smaller letters become more distinct. It appears that their visibility is in proportion to the rate with which the intensity is increased. When people first see this experiment they believe that the cylinder is slowed down by some mechanical device. They fail to understand that as the intensity of the light is increased their

quickness of vision is also increased and they are able to observe more quickly and more minutely anything upon which the increased illumination is directed. Because they see better and more quickly, the cylinder appears to slow down in its rotation. This experiment will demonstrate conclusively that production increases with increased illumination. Employees are able to see moving machinery more quickly and to observe moving parts with greater distinctness when sufficient illumination is provided. When there is not sufficient illumination, and it is necessary for an employe to place his hands at points of operation, he may misjudge the distance and injury may result, detailed observation having been impossible. With the proper intensity and quality of illumination, it is possible to observe details, and an accurate estimate can be made of distance.

Inadequate illumination more or less directly has a bearing upon the accidents which are reported under the following classified causes: Fall of persons; fall of material; running or striking against objects; hand labor, and machinery. If accidents which have been reported under these causes are considered, it is apparent how essential a factor illumination is in eliminating conditions which are frequently the cause of these classes of accidents.

Under the heading, "Fall of Persons," cases are repeatedly reported of persons who have been injured by stepping into unprotected openings or excavations or by stumbling over material left in their pathway. In the dimly lighted shop these excavations, openings, or material cannot be readily seen. If the illumination is increased to such an extent that all such things can be easily seen, the hazard to a certain extent is removed. Good

housekeeping and safeguarding, however, will eliminate it completely. Not so long ago a contracting firm was building a bridge over a small stream.

ness. There is no question but that the accident would not have occurred in the daylight hours or if artificial illumination had been provided. The

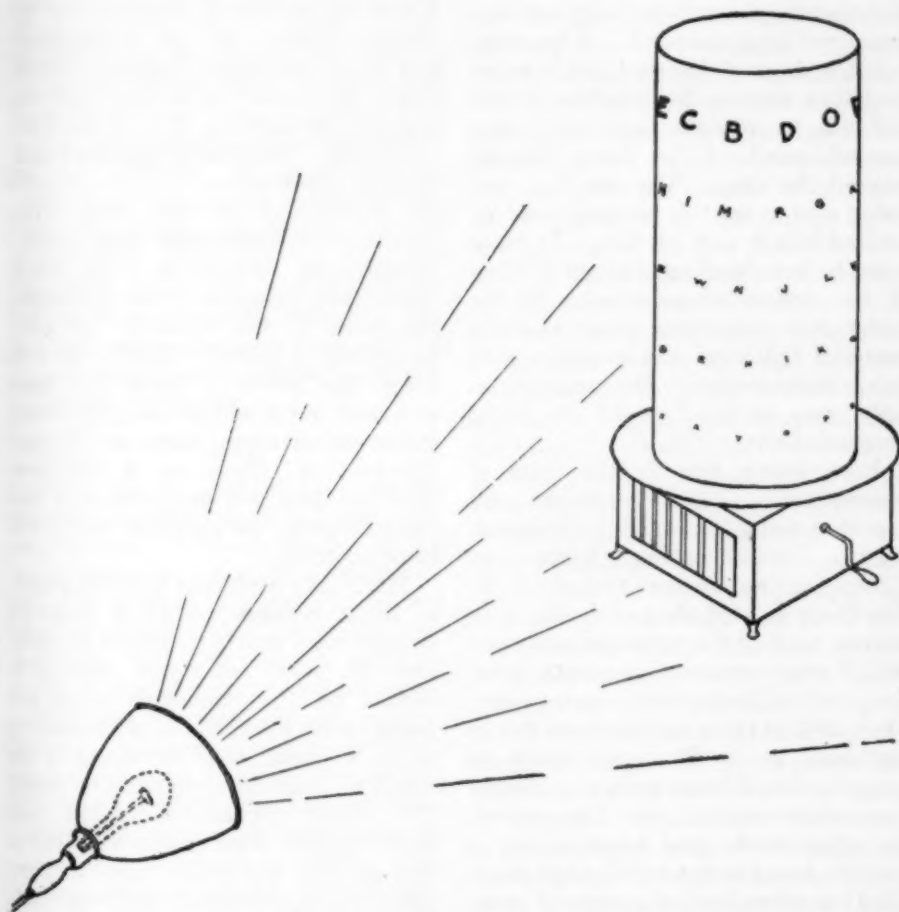


FIGURE 3.—Apparatus to show that increased intensity of light speeds up vision. Cylinder is revolved and various intensities of light projected upon it. As the intensity of light is increased the cylinder appears to slow up in speed and the letters become more distinct.

They reported a fatal accident which occurred to a foreman. The report stated that he fell off the bridge and was killed. * Investigation revealed the fact that this accident occurred at dusk on a very dark day. The foreman either misjudged distance or was unable to see clearly in the semi-dark-

same condition exists during the construction period of most buildings. In the dimly lighted interior, unless special precautions are made to make conditions safe, employes may step into unprotected openings or upon loose boards, or plunge through floor openings. The danger is not readily

discernible, and they unconsciously walk into it.

Under the heading, "Fall of Material," the necessity of proper illumination might be illustrated in the case of a machine shop where heavy castings are moved back and forth. It has been noted in shops of this kind that in years past they were so dimly lighted it was difficult to observe material being carried overhead or being moved around the shop. The employe, not being able to see this material readily, walked into it or it hit him. In some cases he has stood underneath it when it was suspended overhead. In the latter case, something broke and the material fell upon the employe with fatal consequences. He unquestionably was unconscious of its being suspended above him.

In a year's time in the state of Pennsylvania, 15,000 accidents are reported under the heading, "Running into or Striking against Objects," or "Stepping on Sharp Objects." In the dimly lighted shop or in the dark corner, we find the upturned nail upon which some unsuspecting person steps, frequently suffering a fatal consequence. Over 2000 of these accidents are due to upturned nails. It is reasonable to suppose that if these nails were clearly seen, many accidents would be avoided. In other words good housekeeping is usually found in the well-lighted plant. Bad housekeeping is the cause of many accidents and it is usually not found to exist where good illumination prevails.

More accidents are reported under the heading, "Handling Tools or Objects," than under any other cause. The relation of proper illumination to the prevention of such accidents can be best given by a case recently reported. An employe was handling a heavy box in a dimly lighted passageway. He was walking along, and owing to the fact that he was carrying

the box in front of him, he did not observe some loose material which had been left in the passageway. This caused him to stumble, the box dropped on his foot, and he experienced a serious injury, which disabled him for several weeks. If the passageway had been adequately lighted without doubt he would have observed the material on the floor and would have avoided it. In a similar manner a man using a wheelbarrow failed to observe an obstruction in his path. The wheelbarrow overturned and he was injured. Of course, in both these cases faulty illumination was indirectly the cause of the accident. If good housekeeping had prevailed in the first place, the accident could not have occurred; but good housekeeping rarely exists except where there is adequate illumination. However, if sufficient light had been provided, even with bad housekeeping, the accident would not have occurred.

Machinery accidents most frequently occur because employes come in contact with moving parts of machinery. In some cases this contact is caused by the employe's mind not being on his work, but in other cases it seems apparent that the cause is the result of misjudging distance or speed. The master mechanic of a large plant in the Middle West has been quoted as stating that his punch press department was a graveyard until adequate illumination was installed. Other evidence could be submitted which would bear testimony to the effect that adequate illumination on machine work not only lessens the possibility of accidents, but greatly increases production. It is accordingly recognized that inadequate illumination not only produces accidents, but slows up production, causes defective vision, and thereby induces an increase in labor turnover.

IMPROPER ILLUMINATION

The second phase of illumination, which should be considered with relation to its effect upon accidents, is that which can be classed as "Improper Illumination." This includes installations where glare exists, where lights are improperly placed so that there are high lights and deep shadows, and where the illumination provided is not properly diffused. In establishments where such conditions exist, an attempt has been made to provide illumination. However, a lack of knowledge or a lack of study of the conditions which needed changing has resulted only in changing from one bad condition to another, which is equally or even more injurious.

GLARE

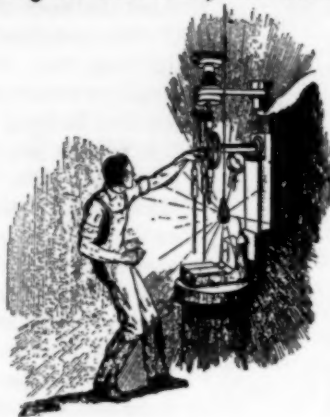
Glare can be classed as being as great an accident hazard as inadequate illumination. If one is unable to see on account of an insufficient amount of light, he is equally unable to see on account of glare which is equivalent to too much light. A common instance of this is the glare produced by automobile lamps which are improperly focused. Any person who has traveled on the highways at night and has experienced the glare from passing automobile lights can realize how dangerous a condition is caused by glare. The driver passing such lights is absolutely blinded momentarily, and is rendered incapable of seeing anything ahead of him. The same condition obtains with respect to a turn in the road. If there were such a turn immediately after the driver had been blinded by the glare of passing automobile lights it is possible that he would fail to see the turn in the road and an accident would result. A similar condition can be caused in the shop or factory.² For

instance, an employe was engaged at work upon a machine tool. The point of operation was illuminated by means of a drop light which was suspended a short distance above the working part of the machine. The general shop lighting was very meager. As this employe was working it was necessary for him to keep his eyes directly upon this highly illuminated portion of the machine. His eyes accommodated themselves to this amount of light and as he turned away quickly to go to another part of the shop, his eyes could not accommodate themselves readily to the small amount of light which prevailed in the other parts of the shop. During the period in which his eyes were accommodating themselves to the change in light conditions he was temporarily blinded, and ran into a projecting piece of material which seriously injured his eye. Adequate illumination in the shop proper not only would have given him sufficient light upon the working part of his machine, but it would also have prevented the necessity of his eyes accommodating themselves first to a highly illuminated portion of work and then immediately to the dark interior of the shop—an impossibility. Faulty illumination was most surely the cause of this particular accident. Improperly located lights will create conditions which in some cases may produce glare, or in other cases produce high lights and deep shadows. The latter is equivalent to conditions found where inadequate lighting exists. If dark shadows exist in passageways or around machines, there is possibility of accidents due to stumbling, tripping, or falling over material or running against articles, which are made difficult of discernment by the deep shadows.

The examples of typical accidents which have been cited clearly demonstrate that inadequate lighting, and

² See Fig. 4.

Blinded by the glare of the bare lamp over the drill-press table, the operator stuck his fingers between gears while reaching for the drill-press feed control.



Jar caused by truck striking bar concealed by shadow on floor knocked truck handle from workman's hand and dislodged pipe .. thereby breaking other workman's leg.



From "Industrial Lighting"

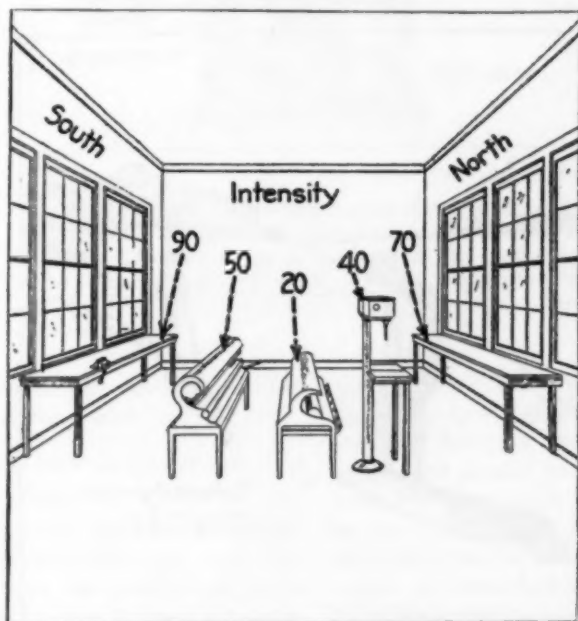
FIGURE 4.—Glare or shadows are equally objectionable. Proper location of lights or reflectors will prevent glare. Lights of sufficient intensity and good diffusion will eliminate dark shadows.

lights improperly placed are the cause of a large number of accidents. While most of the examples given refer particularly to industrial conditions, the same line of reasoning can be applied with respect to accidents on the highways, in the homes or elsewhere, and for that reason it seems unnecessary to give further consideration to the subject. It may not be amiss in the concluding portion of this paper to call attention to the benefits to be derived from illumination of the proper intensity and quality and the best means of obtaining them.

Adequate lighting demands that the illumination installed shall be of the proper intensity and be so diffused that glare will not result.³ The intensity

³ See Figs. 5, 6.

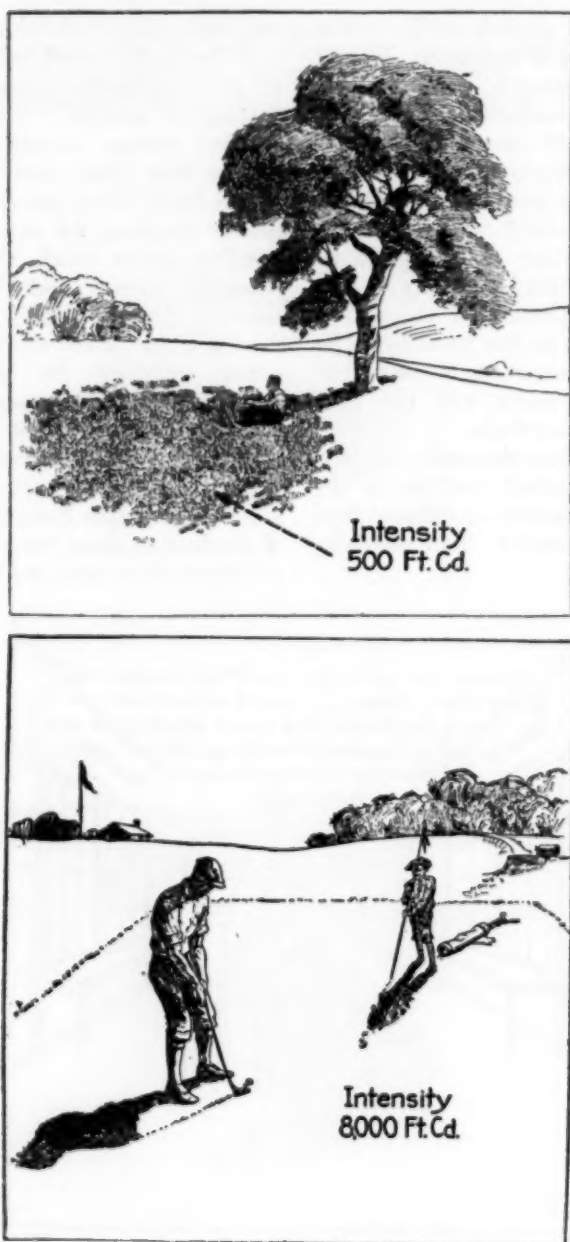
required in any establishment will vary with the kind of work being performed in the particular place where the lighting is desired. Work of a fine, detailed nature requires higher intensity than that required in places where hand labor prevails. The intensity required for safety alone will possibly never reach that which is required when production is considered. It is better, however, to conclude that if the amount of illumination required for production is considered, it will automatically take care of the illumination demanded for safety. For that reason, if industrial executives can be persuaded to consider illumination from the standpoint of production alone, the proper amount of illumination required for safety will



From "Industrial Lighting"

FIGURE 5.—Drawing, showing foot candles of light which can be found in a well constructed factory under daylight conditions.

Many establishments have only two or three foot candles when they use artificial illumination. Is it any wonder that accidents result and production is seriously affected?



From "Industrial Lighting"

FIGURE 6.—Observe the amount of light outdoors.

In the shade of a tree where an intensity of 500 foot candles exists, it is possible to read without discomfort or eye strain. This is due to the excellent diffusion of the light. There seems to be no limit to the intensity of artificial illumination which can be used, provided it is properly diffused. Without diffusion, glare exists and accidents may result.

be assured, the exception being only in places where employees are not working—for instance, in passageways, stairways, etc. Due consideration must

result is that much money is spent needlessly and with improper results. Very frequently the owner of a mill may go to the local electrical contrac-



From "Industrial Lighting"

FIGURE 7.—The foot candle meter is an instrument by means of which the illumination at any point may be quickly determined. The scale on the instrument is in foot candles and can be readily read. Illumination values, ranging from less than .5 of a foot candle to over 50 foot candles can be determined.

be given also to the amount of illumination in these places.

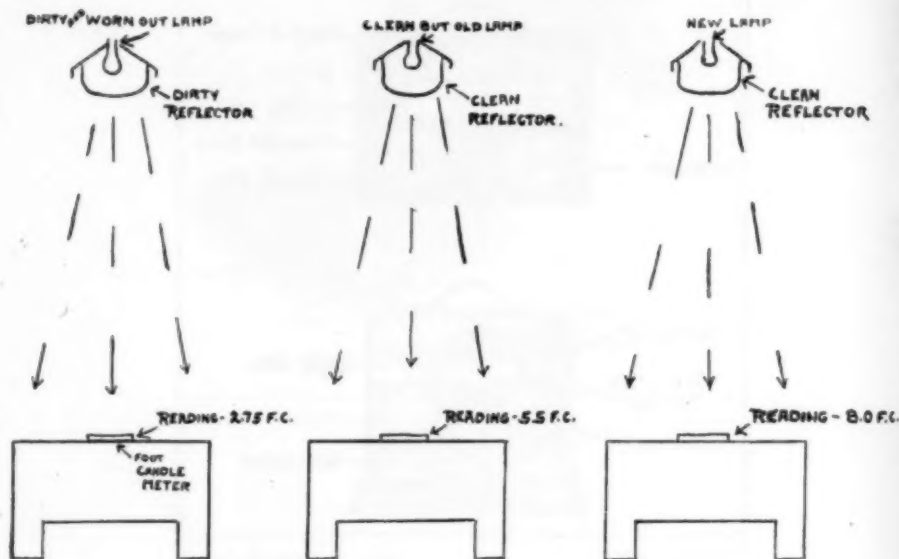
INSTALLATION OF LIGHTING EQUIPMENT

Having assumed that good lighting equipment is essential not only for safety, but also for production, it is next in order for any industrial executive to inquire how a proper system of illumination can be obtained. Experience has shown that too frequently installations have been made on the advice of persons who are not capable of giving proper information. The

tor and state that he desires to have an up-to-date lighting equipment installed. He may state also that this equipment should be placed in departments or in certain parts of a workroom. The electrical contractor, anxious to obtain the contract, asks the owner or manufacturer for more detailed information regarding his wishes, and makes the installation accordingly. The results are not what they should be. As a matter of fact, engineering advice of the greatest value is available without cost to any employer who makes application for it.

Such information can always be obtained by the local contractor from the nationally known lamp manufacturers. Many instances have been known in which these lamp manufacturers have sent engineers of no mean ability to survey the local situation and then give

addition the lamps deteriorate if they have been burned for a period beyond their useful life. This might be illustrated by a simple test.⁴ Directly over an office desk, there was located a light unit of the enclosed type. Inside the dense opal shade and reflector was a



HOW PROPER MAINTENANCE INCREASED ILLUMINATION 190%

FIGURE 8.—The importance of maintenance in illumination is illustrated by the example shown above where a gain of 190 per cent in the amount of illumination on the working level was obtained without any increase in current consumption.

advice concerning the best kind of installation. A high class installation will be put in if the expert's advice is followed.

MAINTENANCE OF EQUIPMENT

It is important, insofar as safety is concerned, not only that adequate illumination should be provided, but that the installation be maintained at its initial efficiency. Lighting equipment deteriorates very quickly if proper supervision and care is not given to it. Accumulation of dust or grime soon lowers its efficiency, and in

200-watt lamp which had been in use for more than one year. A reading was made on the desk of the amount of light which was being given by this fixture. The reading showed 2.75 foot candles. The shade and reflector were quite dirty. After they had been thoroughly cleaned another reading was taken and it was found that the illumination had increased to 5.5 foot candles. It was noticed then that the lamp looked dark. A new 200-watt lamp was installed, and it was then

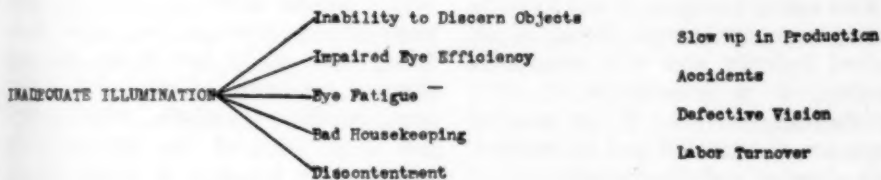
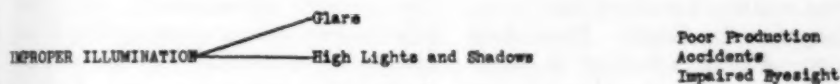
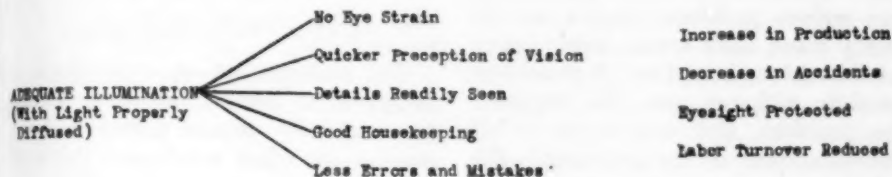
⁴ See Figs. 7, 8.

found that the reading of the foot-candle meter registered 8 foot candles on the desk. In other words, by the cleaning of the fixture and the substitution of a fresh lamp for the worn-out one, the illumination on this desk was increased from 2.75 foot candles to 8 foot candles or 190 per cent without any increase in the amount of current which was being consumed. Such an experiment can be carried out

in almost any industrial establishment with like results.

In conclusion, it can be stated that it is impossible to lay too much stress upon the fact that adequate illumination should be an important factor in every accident-prevention campaign, and if consideration of it is left out, the best results cannot be obtained.

The following table shows the result of both good and poor illumination:



Industrial Safety

Education of the Worker—Fundamentals Upon Which to Work

By M. E. DANFORD

Works Manager, The American Rolling Mill Company, Middletown, Ohio

A VERY good friend of mine was discussing with me a few days ago his mental processes when approaching any serious problem. As we are all pretty much alike I was deeply interested in determining how his procedure lined up with my own. He first read the problem, and arrived at a full understanding of its meaning. His solution comprised two steps: (1) What he wanted to do. (2) How to do it. It sounds simple, but as I cogitated upon the matter, I realized that in its simplicity lies its danger. How often do we spend time and effort in determining how to do something before we decide definitely just what we want to do?

This safety problem, to my mind, is a very complex, simple thing. If attacked logically and with reasonable caution, it is susceptible of very satisfactory solution. If the primary steps are disregarded and overlooked, only disaster and disappointment will result and the subject rather than the methods employed will receive the censure.

On the entrance to a Mid-West high school is this sentence: "The foundation of education is the desire to learn." I might paraphrase this sentence to apply specifically to the safety problem and say, "The foundation of safety in industry is the desire of management and men to be safe." Our problem then falls naturally into two parts, viz.: Selling the management and selling the men. I will consider these two fundamental divisions in their order

because this order of sequence is the one which must obtain or no results will follow.

SELLING THE MANAGEMENT

The management of a company is composed of human beings to whom physical suffering and pain is a keen reality. So often we do not think of the company in this sense and thus lose a very potent argument. The men comprising the board of directors and the general management are fully alive to everything affecting the financial and commercial success of their undertaking and to-day men of affairs realize that safety in industry means not only a satisfaction for lives saved and suffering alleviated, but it also pays juicy dividends in hard cash which can easily be shown to any doubter by scores of examples. Any management, therefore, which does not avail itself of the returns from safety is as lax as if it threw all its scrap over the dump, instead of carefully salvaging and preparing it for financial profit.

The first step toward the realization of the ideal of a safe plant must be for the company to exhibit a sincere belief in safety as a means of saving human life; reducing suffering from accidents; preserving the physical strength and skill of employees; reducing lost time with consequent loss of production and earnings; improving the standing of the company as a progressive, safe employer; and finally of increasing the profits for the stockholders. And

let me say at this point that only a sincere belief on the part of the management in the advantages of safety will accomplish the desired result. Insincerity will be detected. Employees have a very keen appreciation of their employer and they can detect mockery or sham very quickly. They will not be fooled by a pretense on the part of the boss that he is interested in safety unless he shows by example and precept that he is in earnest.

The employer should make clear that he desires the co-operation and assistance of every employee in a mutual desire for safer working conditions, less accidents, less lost time, less cost. He must put the same energy into a campaign against accidents that he would into an endeavor to increase the tonnage or reduce the unit cost. It is absolutely essential that a proper financial program be determined and that it be adhered to with fidelity. Safety cannot be taught by spurts—it must be absorbed daily like nourishment. Periods of fast interspersed with days of plenty are not conducive to a strong body nor a successful organization. Periodical checkups on the safety equipment of the plant and machinery are essential as evidences to the men of the interest of the management—a fact which must never be allowed to lag.

Perhaps some may think I have stressed unduly the responsibility of the management. Experience has shown that when a successful management leads, the men are usually willing to follow. It is for this reason I have mentioned first the responsibility of the company.

SELLING THE MEN

The safety education of the men can be advanced on by a multitude of processes. Once convinced of the attitude of the management, they are usually

eager to follow and assist. The organization should always be reminded of the reasons why the company is interested in safety. The employer should emphasize the humanitarian side of the question and he should also point out that the industrial world in general is preaching and practicing safety to such an extent that dangerous plants are very liable to be discriminated against by careful workmen in search of employment. In times of stress this may be serious because men soon learn to know about an unsafe plant. The fact that lessened accidents save money for the employer should also be frankly stated. It does no harm to tell the organization how much they have saved in this manner, but rather spurs them to greater effort. I know a plant where a year's safety campaign saved enough to build a local hospital and every man in the organization knows it and is proud of it. They tell visitors that they saved the company the price of the building. That certainly does no harm to the relations of men and management, nor does it lessen the prestige of the company with its men.

Departmental or group safety committees should be organized and the competitive spirit between departments aroused. An active safety committee will work strenuously to have a better record than its neighbor, and once aroused the men learn how to put the doctrine across. Vigorous and pointed safety bulletins should be liberally posted and frequently changed. Plant cartoonists will find here an admirable field in which to work and the fact that cartoons and bulletins are home-made and cite home events will increase their punch.

A sympathetic doctor and nurse will work wonders in persuading men to come to the hospital for first aid—and first aid prevents infection. Money

spent for the right sort of medical attention is a wise investment in this day of industrial progress.

The feeling of interdependence of employes for their united safety protection should be encouraged. A tall strapping workman once said to me, when asked how their plant ran forty-five days without an accident: "We watch ourselves and the other fellow all the time." This feeling can be cultivated to the point that the careless are admonished; the forgetful are reminded of their failure to remember; and potential accidents averted.

Think safety. In no other manner can a plant become a safe plant save by its members constantly thinking and acting "Safety." The lapses are marked by accidents. Carelessness is rewarded by suffering and lost time. Make a game of it. Men can be induced to put as much interest into a safety contest as a group of school boys will put into a ball game—with this difference: the men, having a definite goal of high value to attain, are the more grimly eager to win the point. And so by proper leadership,

thoroughly sold on the advantages to company and men of a comprehensive safety program, a normal group of workmen may be thoughtfully led from a condition of wrecklessness with human life and limb—their own by the way—to a position of enviable security from accidents and their blighting results, loss of wages, suffering, and deprivation in the home, permanent bodily impairment, or death. The rewards of safety are so desirable, the end to be attained so thoroughly agreeable to all parties, the returns to management and men so prodigious that it is difficult to see why any should hold back. Happily the safety idea has inoculated the nation and the knowledge of its happy rewards are spreading so rapidly that it will not be long until industry in even the most backward community will be calling its safety meetings as regularly as it now calls its foremen's meetings. Let us do all we can to bring that day nearer and thus lessen the flood of human suffering which follows the unsafe organization, no matter where it may be.

Putting Safety Across to the Worker

By CARAL B. COXE

Associate Editor, *The Atlantic Seal*, Atlantic Refining Company

THERE is a fascination about the study and application of Safety First principles—a fascination, because it concerns directly the saving of life and limb; because it thereby appeals to men's better natures, and because there is a corresponding satisfaction in noting the results of the efforts expended.

The conflicting methods and experiments employed in this movement in the past are well illustrated by the story of the two clergymen whose congregations had long been at bitter ritualistic warfare. One day these clergymen met on friendly terms, and the first one said to his fellow worker, "Brother, let us forget our differences; we are in the same work for the same end, so let us bury the hatchet. You worship in *your* way, and I'll worship in *God's*." The time when such an attitude with regard to human safety was prevalent has happily passed.

Accident prevention, or as we now call it through lack of a better slogan, "Safety First," has reached the third stage of its existence. A subject of ridicule and sarcasm in the beginning, it quickly became a source of argument and bitter discussion. It is now an accepted power and an integral factor in every successful industrial organization. The reason for this is threefold: first, because of the keen desire on the part of management to insure safety to all employees; second, because of the extensive invention of mechanical devices installed to protect the workman; and third, because of the successful utilization of these devices by the employee. However, experience has

taught that it is not enough to merely *provide safety devices*. They are all right so far as mechanical protection is concerned, but they do not guard the workman against the unusual, the unexpected risk which he himself or a careless co-worker may originate—and these risks are by far in the majority.

In most of the big industrial concerns certain rules and regulations are set forth, and if these rules and regulations were always carefully followed, accidents would be few. But human resolutions and purposes are frail things at best, and while the average workman is normally careful, there often comes a time when a little lapse, inattention to the duty at hand, a sudden swerving of thought for a single second—and the accident has happened.

A careful survey of available statistics shows that approximately seventy-five per cent of all accidents are preventable, but that of this number only about twenty or twenty-five per cent can be prevented by mechanical safeguards. The balance are accidents that can only be prevented and eliminated by safety education of the workmen. When the workmen in any industrial plant have absorbed and assimilated the idea of safety, then, and then only, has the safety goal of that plant been reached.

WHAT THE PLANT MAGAZINE CAN DO

How is this safety education to be obtained? Is there a better medium than the plant magazine? How can it best be used in putting safety across to the workers? Are the returns sufficiently large to justify the expenditure

of the vast amounts annually made through this channel?

Pertinent questions, indeed, and hard to answer either accurately or satisfactorily, since the influence of the plant publication is subtle, and cannot be measured in dollars and cents. The income on this investment cannot be reduced to liquid assets, but who doubts that it exists? The statistical shark can figure exactly the per cent of reduction on accidents, but who can estimate the countless thousands saved each year—saved from physical suffering and financial loss—by reason of their having been taught the habits of safety!

Wilful carelessness is a rare occurrence among the average workmen, but recklessness and thoughtlessness are ever present, so it is necessary to plant the sign posts of safety all along the way to remind them of important precautions which they might otherwise forget, and to prevent them from wandering from the straight paths of safe workmanship into the slippery detours of negligence and unsafe practices.

Just here is where the plant publication can get in some excellent work, by discussing dangerous practices, pointing out the value and necessity of watching out for the other man's well being, and instilling a spirit of emulation through the non-accident record of a fellow worker—instilling a pride in living, rather than a fear of being maimed or killed. Without doubt the plant or company paper is one of the best vehicles by which this message may be carried, and it is the job of every plant editor at the present time to figure out the means by which this can be accomplished most effectively in his own organization.

Many plant editors run out a special safety edition at regular intervals—yearly or semi-yearly—and feel that

the benefit derived from it more than compensates for the extra effort and work entailed in its compilation. In our plant—The Atlantic Refining Company—we have never issued a special safety number; its value is still debatable with us, and we are rather inclined to believe that safety presented regularly throughout the year is more effective than a special safety edition. So we devote a part of each issue to safety material, keeping before the men continuously, in the most interesting and arresting way possible, the theme of protecting themselves and others. As an instance, a canvass of the plant one day revealed the fact that in the company's employ were nine men whose length of service aggregated 410 years, and that during this four centuries of work, none of them had ever had a lost-time accident. Here was a wonderful record! An almost unbelievable record which should prove not only interesting to every other employe, but also be means of stimulating others to strive for a similar record. The oldest in point of service had fifty years to his credit, and the youngest forty-eight. Photographs of these men, together with a brief history of their work and record, was used in the plant paper with gratifying results, and many highly complimentary letters on that double page of honorable veterans were received. Of vitally more importance, however, were the comments from workmen throughout the plant who desired to be reckoned among the "safe men."

Although it may not be possible to show definitely just how much good results from the efforts of the plant magazine, it is evident that the safety movement is growing and being strengthened all over the land every day, and that men are taking more pride in their non-accident record as the days go by. And it is only fair to

assume that the plant publication is responsible for at least a part of the interest manifested.

The publicity of the account of accidents will never stop accidents, any more than the publicity of the account of crime will prevent theft or murder. It is necessary to educate and elevate the morale of the men to want a safety-first record, and that will create a spirit that will make for careful efficiency.

A young man in one of the large industrial plants in Philadelphia had the end of his finger torn off in an accident the other day. The department of which he was a member had been striving for a 100 per cent no-lost-time record for that month, and up to the day of his injury its record was perfect. Although his accident was mighty painful, and after the doctor dressed it he was advised to go home and remain there for a few days, this young man was so anxious to keep that 100 per cent record perfect that he refused to leave, even for the balance of the day, and insisted on going on with his work. The morale of his department did it.

DRIVING THE SAFETY MESSAGE HOME

There are many ways by which the safety message may be put across to the workers so effectively that it must be absorbed. In our own plant magazine we are running at the present time a series of safety cartoons illustrating a limerick with a missing last line. For the best last line completing the limerick turned in by an employee, a prize of a crisp dollar bill is awarded. Every month the answers to the limerick run into the hundreds, showing that the men not only read that safety message but are sufficiently interested to enter into competition concerning it.

In these limericks only the ordinary, every-day hazard which the careless

or thoughtless workman meets in his daily occupation is stressed, and the cartoon which illustrates the limerick is so cleverly drawn that even the most stupid person cannot miss the point.

Experience shows that better results are obtained when a man's sense of humor is appealed to than if he is confronted with the grewsome and horrible effects of fatal accidents. In the former instance he chuckles over the discomfiture portrayed in the cartoon, shows it gleefully to his friends and congratulates himself that he is not such a chump. In the latter case, he is apt to give one swift glance at the horror so vividly brought to his attention, and hurriedly turn the page. Occasionally it may be necessary to drive home more forcefully the ghastly results of a few seconds of carelessness, but for steady diet the humorous, understandable cartoon conveys the lesson perfectly, and is an effective method of putting the message across to the worker.

Every intelligent man in the industrial field to-day realizes that it is the careless worker who always pays—in suffering, financial loss and home worry. He sees a workman beside him injured, through carelessness, perhaps, and he realizes that his neighbor took a chance, and lost. But the human family is optimistic. Realizing fully that carelessness and negligence and indifference cause accidents, most men are so optimistic as to believe that while it happened to the other fellow it won't happen to them. There can be no let-up, therefore, in education to secure respect for the rules of safety through regular presentation of safety publicity.

The plant publication has still another advantage in putting the message across to the workers—it reaches the home folks—and the influence of the home circle is tremendous. The plant editor should find out what the

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The plant publication has still another advantage in putting the message across to the workers—it *reaches the home folks*—and the influence of the home circle is tremendous. The plant editor should find out what the

Safety First Limerick Contest



Cornelius John Henry DeBurk
 Was careful and safe while at work
 But when he was through
 He forgot all he knew
And all codes of "Safety" did shirk.

home folks like, how they like it, and then give it to them. He should put his safety message across so forcefully and so diplomatically that they cannot help absorbing it, and they, from their end of the line, will see that their hus-

bands and brothers and friends accept the message. The plant editor who wants to get his message across to the workers must not preach—even the home folks resent that air of paternalism assumed by many editors. He

Safety First Limerick Contest



A grouchy guy, Isaac Maloney
Said "Safety First—Bah!—that's bologney!"
'Til he once looped the loop
When he stepped on a hoop
'Tis "Ikee" Not "Safetee" That's Phoney.

must not nag—no one likes to be nagged at, and suspicion and skepticism are unfortunately to be found in the minds of many employes in the industrial world. He must not threaten—results obtained by threats are always negligible at best. He must spend a little time studying the men, their home

conditions and interests, and through that medium get his safety message to them so convincingly that the men will want to work safe, and point with pride to their own record or the record of their department, when the home folks read about it. He must make his readers realize that the deliberations

and suggestions of the safety committee are not an abridgment of the rights of an employe, but are intended for his protection and well-being.

The plant editor must not make the mistake of turning a plant publication into a safety magazine; he must make his magazine interesting with readable articles, jokes, pictures, anecdotes about the men in the plant, and whatever of company policy is feasible. Sandwiched between other delectable bits may appear his safety material, so cleverly blended and harmonized that no startling effect is noticeable.

The safety message cannot be crammed down men's throats; nothing can be accomplished by strict rules and threats and punishments. Men must be made to *want* to work safe, and only by constant, diplomatic and intelligent teaching can this desire be created.

When the plant publication has succeeded in creating this desire, it has made long strides in the direction of non-accident workmanship, and can rightfully claim the honor of helping in the great task of "putting safety across to the workers."

The Foreman's Responsibility for Accidents

By MATTHEW LUND

Furniture Mutual Insurance Company, Grand Rapids, Mich.

WHY IS A FOREMAN?

WHEN industry was in its infancy, master and helper constituted an establishment. As the helper acquired some of the master's knowledge, but more of his skill, the helper or apprentice became a craftsman, and as new helpers were added the original helper became the first man, later named "foreman." The foreman represented the master when he was absent, and was in every respect considered as his equal in skill, but not quite his equal in knowledge or education.

The writer learned his trade under one of the oldest Guild Rules, and one of his fondest recollections is the obligation he assumed when he became a craftsman. Translated it says: "I promise to so instruct the apprentices who work with me that they shall be better workmen than myself." This is followed by the assurance that, as they are better men, they will never work for less wages; but as it is customary to test one's ability, the craftsman must set out to foreign lands, and find out how little he knows.

Thus it will be observed that, even in the remote Middle Ages, the foreman had his responsibility outlined. While his duty was at that time patriarchal, it governed the welfare and morals of all under his care. Every guild had its own ritual and ethics, which translated into 20th century language means as scientific management as was known at that period. Instruction under these rules was very specific and an apprentice who broke any of the rules was first punished,

next told what dire results would happen to the craft if such habit were permitted. This pride in the craft was a constant spur to every craftsman to glorify his master's achievements by his individual effort and intelligence.

WHAT IS THE MODERN FOREMAN'S JOB?

Is he to be a white collar man or a man among men (the first man), circulating among his force, giving an admonition here, a helping hand there, a nod of approval to one; or perhaps take a hand at adjusting a rebellious machine; never playing favorites, but insisting on strict enforcement of all rules which include safe practices. Should he be responsible for the selections of his men on the staff, or have them forced upon him by a perhaps well meaning but little knowing employment manager? Should he be burdened with stock movements or cost keeping? The answer should be "no" to the last duties, but "yes" to hiring his requirements.

The modern complex of industry includes all of the elements required by the foreman of ancient times. In addition he must travel in foreign countries; that is, he must study into the mysteries of men's minds, as well as the development of the industry in which he serves. This knowledge is much easier to acquire to-day than it was fifty years ago. At that time the craftsman put his tools on his back, took a staff in his hand and hoofed to a far-off land, where he did not understand the language spoken. To-day the modern trade journal furnishes the journey.

Dr. Jacobus, in a recent address, made this statement:

The great frontiers of civilization to-day are the boundaries between knowledge and ignorance, and upon the skill and perseverance of the pathfinders into the unknown, depends the well-being of mankind.

This page out of my fifty-year book of experience fully convinces me that the foreman is the most important factor in our efforts to promote safety and avoid accidents.

The old saying, "As the master leads, the men will follow," holds good to-day. My ideal foreman should be a man of mature years, who preferably has learned his craft in the same line of work, is a master craftsman with a well-governed temper, and has also the quality for human sympathy with the men under his charge. But his principal requirement should be *love for his work*. Given such a man, his influence will permeate the entire force and his craftsmanship, demonstrated to his men, will invariably insure production of a high standard, devoid of accidents to men or materials.

To what extent should a foreman educate his men in safety? If he will select his men with an eye singled for an alert mind, a few well chosen demonstrations will suffice, but a constant touch must be maintained with every individual consciousness. Therefore, no stereotyped rules will be advisable or adequate. Here the first-named qualifications come into action. Patience may wait long for its reward. This reward should be an assurance that the man will love his work and endeavor to master his problems.

The position of a foreman is one hard to fill and not the easy berth which a great many think it to be. Many foremen wish they had never accepted the job, there is so much work to do, and a turmoil of criticism and strife is

ever present. Superintendents clamor for production and men respond reluctantly to the increased demand. Where such a condition prevails, foremen become surly, violent or taciturn, get an "I don't care," "I have done my best" spirit. The outcome of such a condition will be careless, faulty work, neglected machinery, chaos will ensue, accidents will increase, and ultimately the foreman will be removed. Perhaps it was not his fault entirely, but—he is the first man.

HOW ONE ORGANIZATION FUNCTIONS

I am happy to state that I fill a unique position and am employed by a unique group of manufacturers, fifty-eight, to be exact—the Furniture Manufacturers' Association of Grand Rapids, Michigan.

Here are employed an average of twelve thousand men in the making of furniture. It is called manufacturing, but it is really building, as there is an individual consciousness used in the choice of every stick of wood, from the drykiln through its entire progress to the finishing room. Here you may see a man lifting a block from a truck, viewing it from all angles to observe its grain or figure, before he starts to cut its shape. These men are zealous of the product of their employers and proud of the achievements of the plant in which they are working.

Here you may see the craftsman with the well-worn hammer handle, (described by Forrest Crissy) working beside his grandson, lovingly showing him how; or the artist, who decorates with so much care the high priced suite for some wealthy home. Here, also, you find the swift running machinery with spindle speeds up to 12,000 r.p.m., where a man may lose a finger without knowing how it happened, if he forgets his job.

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Here you may see owners, superintendents and foremen raised from the ranks, all imbued with their pride in craft and the desire to make more beautiful furniture. Here every foreman automatically assumes responsibility for the safety and comfort of his men, and co-operation from master down to common laborer is assured to the safety movement.

However, with all of this splendid spirit, a constant check is kept on every department in all of the plants and every scratch, sliver or cut is marked on a perpetual chart as an accident. This chart, in addition to the accident records, shows the physical safe condition of every department in every plant. This chart, a copy of which is illustrated, is eagerly scanned by foremen as well as by owners and superintendents for percentages of gain in physical safe condition and loss in the accident column. It should be stated that all plants are appraised by one man, hence

if one is wrong, all are wrong. My records of investigations show that a heavy burden of responsibility falls on the foreman. When an accident is reported, a complete investigation is made by the writer, and where neglect or responsibility can be placed, censure is rarely applied, as foremen have come to me with tearful countenances, stating that they might have averted a certain accident, and promising that they would never take a similar chance again. The investigation is for the specific purpose of ascertaining the complete knowledge of all of the surrounding circumstances and then surveying the entire group of plants for similar hazards and eliminating the hazard where found.

My instructions are: *One accident of a kind is enough.*

My constant plea is for a greater appreciation of the good foreman and for the education of young men to take his place.

Sustaining Interest in Safety

By JOHN A. OARTEL

Chief of Safety Bureau, Carnegie Steel Company; Director, National Safety Council; Vice-President, Western Pennsylvania Division, National Safety Council; President, Pennsylvania Society of Safety Engineers

THIS subject will be treated under three headings, namely: (1) The Physical Plant; (2) The Safety Organization; (3) The Personal Equation.

THE PHYSICAL PLANT

When the subject of sustaining interest in safety is mentioned, the mind naturally turns to safety committees or to employes who have lost interest or who need to have their interest quickened. It may be, however, that the loss of interest on the part of the employe can be traced to lack of interest on the part of the employer. Unless the employer has consistently and conscientiously kept abreast of the times in safety, he cannot lay the entire blame for lack of interest in safety on the employe.

One of the ways in which an employer can show his sustained interest in safety is by adopting new methods, devices and processes that are developed from time to time. I do not, of course, mean to infer that all schemes brought to his attention should be adopted, but he should at all times be ready to listen to suggestions for improved safety in his plant. This may mean at times the expenditure of considerable sums of money for new or improved equipment or new devices.

The contribution of the engineering profession to safety has been very marked, and the application of electricity and other sciences in the way of improved machinery and processes has aided safety very materially. The

employer who takes advantage of all these developments to add to the safety of his plant, is taking a large stride in maintaining the interest of his employes in safety. A specific instance will illustrate: In building a group of bar mills, it was planned to eliminate the crossing of railroad tracks and the passing to and fro of men over the roll tables. To accomplish this object subways were built by which the employes could gain access to the plant and to the different departments without finding it necessary to cross any railroad or roll table. The physical construction of this plant is an abiding testimony to the men of the employer's interest in safety.

SAFETY ORGANIZATIONS

The safety organization of an industry has a great deal to do with maintaining interest in safety on the part of the employes. The safety organization should be controlled or directed by a safety director if the plant is large enough, or by one of the officials if the plant is small. Great care should be exercised in his selection, as upon him, more than upon any other person, will the success of safety depend. He should be a leader of men. One who can inspire employes with high ideals and lead to their attainment. He should be a lover of men, able to take unpromising human material and mold it to work harmoniously for safety. When he takes up the work halfheartedly, and does not put a large

measure of enthusiasm into the work, it will fail of the best results.

The organization that functions properly is one that is well fed, whether it be a man, an animal, a plant or a safety committee. Much of the indifference and lukewarmness on the part of the safety committees and the meagre results obtained by them has been due to the fact that they have subsisted on a starvation diet. It is not sufficient to appoint safety committees and leave them to their own resources. They must be fed with safety food. An efficient department safety committee in a large steel mill has the following order of business which keeps the meetings interesting:

- (1) Reading of minutes of previous meeting.
- (2) Unfinished business.
- (3) New business.
- (4) Reports of accidents.
- (5) Communications.
- (6) Reports of what members have done since the last meeting to prevent accidents.
- (7) New suggestions.

Newspaper and magazine clippings, and articles referring to some phase of safety, prints, photos or circulars of new safety devices, reports of accidents, near accidents or dangerous practices should be fed to the safety committees continually.

The promotion of co-operation is very vital to maintaining interest in safety, and should be fostered by the safety director and safety committees. This was illustrated very forcibly to the writer not very long ago in connection with a "No Accident Month" in an industry employing sixty-five hundred men. In preparing for the drive the safety director and myself visited every department in the plant to meet and talk with the department superin-

tendent, the safety committee and groups of employees. I was particularly impressed with the very able manner with which one of the department superintendents handled the matter. He was not satisfied with anything less than complete co-operation with the safety director. It was not enough for him to bring the safety committee, the foremen and the gang leaders to the office to hear the talks—his ambition was to have his full force hear about the safety drive and to participate in it to the fullest possible extent. He had his entire force come to the meeting place in groups of fifty or one hundred. Safety bulletins, signs and slogans were displayed on the walls. Safety devices used in the department were displayed and their use explained to the men. An orchestra was recruited from the men in the department which entertained the men while they waited for the speakers.

After one of the meetings this superintendent, who was in charge of the electrical department, said to the writer, "I am trying to instill the thought of service into the minds of my men. I am telling them they are the service department of the plant. I am trying to get them to understand that the continuous operation of the plant depends on the character of the work they do." He was employing safety and service, twin handmaidens, that will bring any industry to the heights of efficiency.

PERSONAL EQUATION

Organization and safeguarding will reduce accidents from twenty-five to fifty per cent. The remainder must be done by education. The problem is to take adult minds accustomed, perhaps, to habits of thoughtlessness and carelessness and educate and train them to *think safely*. In order to accomplish this, all avenues of approach

to the individual must be utilized and all measures taken to keep safety before the workmen continually. The employer may be an earnest advocate of safety. The safety director and safety committees may function to the best of their abilities and yet the safety message may fail to reach and take root where it properly belongs in the consciousness of the individual workman.

The following suggestions for maintaining interest in safety are not merely theories, but have been successful in steel mills employing from one to fifteen thousand men each.

(1) *Plant Rallies.*—The writer recently had first-hand contact with a large steel mill employing seventy-five hundred men, which reduced lost-time accidents sixty-three per cent within a year. A "No Accident Month" was planned to start the campaign. A mass meeting of the department superintendents, foremen and key men was held in a large auditorium on a Saturday evening, preceding the drive. The general superintendent of the plant was the principal speaker. In his address he told his official family, simply and in plain words, the object of the "No Accident Month," and that he looked to everyone for their hearty support. This straight from the shoulder talk from the "Big Boss" went home, and all realized that the company was back of the drive with its full support.

Rallies were held once a week at each of the four plants under the jurisdiction of the general superintendent. An outside speaker was brought in to address these meetings. Five minutes before the time appointed for the rally, the whistle was blown; the plant shut down and the employees gathered inside a large building for the meeting. The meeting was a half hour in duration, the safety engineer talking about five minutes to tell of the progress of the cam-

paign, after which the principal speaker addressed the meeting. After the "No Accident Month," the meetings were continued monthly for a year, the result being a reduction of sixty-three per cent in lost-time accidents.

Another feature of this campaign was the placing of score boards at the entrance to each plant and department on which the accident record was posted. Bulletins and slogans were also posted at numerous places. Occasionally a pair of goggles which had saved an eye were displayed on the bulletin board and the story told at the meetings.

(2) *Department Rallies.*—A fabricating department in a steel mill, involving large punch press operations, and employing three hundred men, adopted the plan of holding a safety rally for the workmen once a week. These meetings are held on Saturday mornings each week for a period of twenty minutes. A platform draped with an American flag is used for the speakers. The foreman of the shop calls the meeting to order, after which the audience stands and sings "America," following which the speaker is introduced. Sometimes a quartet is secured, which renders some special music. The speaker may be a man from another department, someone who volunteers from the men themselves, or an outside speaker may be secured. Any dangerous practices noticed by anyone during the week are brought to the attention of the men with a warning against their repetition. These meetings have been held weekly for the last five years, during which time there have been no lost-time accidents, compared to an average of one per month before the rallies were held.

The general superintendent of a plant employing twelve thousand men, who had just been appointed to the position, decided to take an active interest in an "Accident Reduction Campaign." He went around to each

department or division of the plant, without any previous notice, shut it down, assembled the employes, and gave a fifteen-minute safety talk. By this method he came into direct contact with every man in the plant and lost-time accidents were reduced fifty per cent.

(3) *Spirit of Competition.*—The subject of a prize or bonus to the foreman or workman for engaging in safety activities has always provoked discussion and argument. There is a happy medium which may be adopted by all with good results. The spirit of competition in safety, between plants or departments, will arouse enthusiasm, promote interest and bring a decrease of accidents. This plan has been in successful operation by a large steel company, employing fifty thousand men, for the past four years, and has brought a decrease of eighty-five per cent in lost-time accidents during that time.

The award is in the form of a bronze trophy, from three to five feet high, and is a symbolical figure representing "Safety." The trophy is awarded monthly to the plant making the greatest reduction in lost-time accidents, compared to the average for the previous five-year period. At the end of the year, the plant which shows the greatest yearly reduction is awarded the trophy permanently. In this competition, the plant that wins the award is the one that reduces its own lost-time accident percentage most. This company has a plant of six thousand employes which now has an average record of thirty-five lost-time accidents per year which, before this competition began, had an average of five hundred and eighteen lost-time accidents per year. The award of a department trophy in two of the plants of the same company is also producing good results.

(4) *Talks by Foremen.*—One of the most successful ways in which interest

in safety has been maintained in a large steel company has been to have each foreman give a short safety talk to his gang at the beginning of the turn. This need not be a formal talk, but may be in the nature of instructions with reference to the work they are about to engage in. This method has proven particularly valuable with labor and mechanical gangs. The men are assembled in the tool room for five minutes at the beginning of the turn. The special job for the day may furnish a topic for the talk, and special emphasis may be laid on safe tools and the avoidance of dangerous practices. A blacksmith shop, with a force of one hundred and ten men, adopted this method not long ago. The foreman stands upon an anvil with the men gathered around him. Because of the peculiar rostrum selected by the speaker, the meetings have become known throughout the plant as "Anvil Talks." Special attention is given in the talks to lifting chains, as this shop makes and repairs a large number of the same. Since these five-minute meetings have become a daily feature, this shop has eliminated lost-time accidents entirely.

In closing, the writer desires to relate an incident which occurred in a department safety committee meeting in a steel mill, which includes several of the ideas and suggestions he has sought to embody in this compilation.

A foreman, who had charge of a shipping gang in a large plate mill, told the committee how he secured co-operation for and maintained interest in safety. He said:

When a new craneman comes into the department, before I permit him to make a lift, I call him down from the crane for a heart-to-heart talk. I instruct him fully in the operation of hooking on to, lifting and transferring a steel plate from the stock pile to the railroad car. I then send him

back to the crane cab to begin work. He has not only been instructed in the safe way of doing the work, but has carried back with him a kindlier feeling for myself and the loading gang, and a desire to co-operate with us.

This shipper has gone "the second mile." He has imparted that spirit of kindness and co-operation that will produce efficiency of operation along with safety.

Relation of Workmen's Compensation to Accident Prevention

By JOHN B. ANDREWS

Secretary, American Association for Labor Legislation

TALK with any three men who actually know from personal experience what has been done to prevent work accidents and they will probably say, "Workmen's compensation has been a principal factor." Ask them to prove it in statistical terms and, if they are wise, they will tell you it can't be done.

This impotence of statistics is freely admitted by the labor statisticians themselves. Aside from a few suggestive promises of what they might perhaps do in the future if given adequate appropriations for their work, they are as helpless as the man on the street. The result of the continuous financial pressure exerted by workmen's compensation laws cannot be measured in figures. It is impossible to separate the powerful stimulus of accident compensation from other influences working toward industrial safety.

But in dealing with some questions daily observation and common sense are worth more than a five-pound book of statistical tables, and when tabulated figures are lacking, expert opinion is especially welcome and valuable. A brief survey of the development of the compensation movement and the closely following national movement for accident prevention is instructive.

The first state workmen's compensation laws to go into effect and stay in effect were enacted in 1911. The very next year a group of employers and technical advisors held a meeting out of which later grew the great national organization of individuals and companies interested in the promotion of

safety in industrial establishments. A familiar statement by employer speakers at their safety conferences runs like this: "Our state passed a workmen's compensation bill in 19—, and we then realized that as a matter of dollars and cents alone it was up to us to get busy and prevent accidents." The Director of the National Safety Council in 1919, in addressing the annual meeting of the American Association for Labor Legislation, said:

State compensation laws have played a most important part in stimulating safety. . . . During the five years that I was connected with the Wisconsin Industrial Commission, accidental deaths were reduced 61 per cent. Judging from this experience, it is, I think, fair to say that one-half of the credit for this accomplishment must be given to the stimulus which the compensation law gave to the whole safety movement.¹

So much by way of introduction of expert opinion based on intimate observation. How about the reasoning from the viewpoint of common sense?

Employers of labor are commonly considered to be "hard-headed business men." No doubt many of them are. Before the coming of workmen's compensation these employers commonly bought a policy in a stock casualty insurance company, paid the premium for a year, and when their workmen suffered accident they relied upon the insurance company's lawyers to defeat most of the comparatively few suits for damages.

In order to win a damage suit the

¹C. W. Price, in *American Labor Legislation Review*, March, 1920, Vol. X, pp. 25-26.

injured workman was obliged to show that the injury was the immediate result of the employer's failure to exercise ordinary care, and that it was not contributed to in any degree by his own lack of ordinary care. Moreover, he could not win if the accident was due to an ordinary hazard of the employment, or to the negligence of a fellow workman, or to a defect due to the negligence of the employer that was known to the injured and that created a condition under which a prudent man would not have continued to work. Taking advantage of the weakness of the injured worker, the casualty insurance companies with experienced lawyers acted as a rule as if their duty was not to compensate the injured, but to defeat their claims. It is not surprising, therefore, that few of the injured workmen recovered damages. And it was natural under such a system for hard-headed employers to consider accidents "inevitable," and to look askance at safety laws placing definite responsibility upon the employer. If anyone thinks this too dark a picture, let him study the *present* situation in Missouri or any other of the remaining non-compensation states.

VALUE OF WORKMEN'S COMPENSATION

Then after further struggle came workmen's compensation. It is revolutionary. No longer is to be raised the question of fault. Following an accident a detailed report must be made by the employer. Medical care must be furnished at the expense of the employer. In general, if the injured person is obliged to leave work or as long as one week he is thereafter to receive during disability—likewise at the expense of his employer—a fixed percentage of his wages under certain carefully worked out limitations. There is no suit for damages.

The benefits of the law are commonly administered by an industrial commission, very often also charged with the duty of drawing up and enforcing regulations for industrial safety.

In the single state of New York, employers now pay in premiums for their compensation insurance more than \$40,000,000 yearly to casualty companies alone. Nearly \$4,000,000 more is paid to the competitive state fund, and, in addition, it is estimated that the large employers who are permitted to self-insure pay out directly another \$4,000,000 in compensation. This annual compensation cost of approximately forty-eight millions of dollars in one state is suggestive of the financial incentive to prevent accidents. Is it surprising that employers have had their attention called to their accident prevention problem? At the National Safety Congress in 1925, a New Bedford manufacturer still recalled and frankly said: "Our first real interest in safety work was forcibly demanded of us by passage in Massachusetts in 1912 of the workmen's compensation act."²

The employer is not only stimulated by the money incentive; he is educated to the best safety practices (of which he was frequently ignorant) when once the money incentive puts him in a receptive mood. Safety organization and safety engineering have taken hold largely to the degree only that employers have come to realize that they are sound business propositions and not "frills."³

To the employer who is permitted to carry his own risk, it is of course

² A. L. Emery, quoted in *The Textile World*, Oct. 3, 1925.

³ Arthur H. Young, of the International Harvester Corporation, in a lecture on Safety Education and Shop Organization, said: "I say to you that the employer can, and should, be approached on a straight 'dollar and cents' basis."

obvious that under workmen's compensation every accident prevented is clear gain. And one of the most interesting features of the annual safety conferences has been the rivalry of some large companies in reporting the extent of their accident reduction. Many establishments can now boast that they have reduced their accidents more than 70 per cent.

If the employer carries compensation insurance he receives credits for guarding danger points and in most states he also receives an additional credit for favorable accident experience during the preceding five years. Moreover, some compensation laws provide that the employer shall pay 15 per cent increased compensation if the accident was caused by his failure to comply with any statute of the state or any lawful order of the administrative commission relative to safety. Likewise the injured worker has his compensation reduced 15 per cent if the injury is caused by his wilful failure to use safety devices provided by the employer or to obey any reasonable rule adopted by the employer for the worker's safety. Such special provisions and compensation laws as a whole, by furnishing a direct financial incentive, have a profound effect upon the prevention of accidents. Experienced industrial commissioners, without hesitation, declare this is true. R. G. Knutson, of the Wisconsin Industrial Commission, in a letter to the writer on November 23, 1925, said:

I believe it is impossible to demonstrate statistically the effect of workmen's compensation on the prevention of accidents but anyone charged with the responsibility of administering a workmen's compensation law cannot help but observe its effect on safety work.

One could summon in support of this common-sense position a cloud of

witnesses. In the limited space available the following typical examples will suffice. Within five years of the coming of workmen's compensation laws, Leon S. Senior, as manager of the New York Inspection Rating Board, announced: "It is well recognized by all students of the subject that the greatest amount of progress in the direction of accident prevention has been made during the past few years since the introduction of workmen's compensation laws." At the same time Carl Hookstadt, as Federal government expert, pointed out that immediately after the passage of workmen's compensation legislation, "Casualty insurance companies entered upon a new era of active accident prevention, which was shared by many of the larger manufacturing establishments throughout the country." Herbert Wilson, as director of inspection and safety for associated insurance companies, likewise said in 1916, "Workmen's compensation legislation is a powerful instrument for greater safety in the industries." He reported that under the first six months of the Pennsylvania compensation law, the average safety condition of the bituminous coal mines had been improved from 75 per cent perfect on the standard scale of measurement then adopted to 92 per cent perfect. Employers were learning the possibilities of cost reduction based upon their efforts toward accident prevention. Rating became an important factor in the safety movement, and Mr. Senior, one of the authorities quoted above, then said: "Exact statistics are not available as to the exact effect of schedule rating upon loss reduction, and no method has been discovered to measure that effect in a mathematical manner," but "the system must appeal to the employer with an effect that no other appeal can possibly have." Seven years later the U. S.

Coal Commission, following a study under the direction of Dean E. A. Holbrook, reported that "One of the most effective means of preventing accidents in coal mines has been the development of schedule and experience rating for compensation insurance." And E. H. Downey, the able actuary of the Pennsylvania state compensation fund, wrote into his last book the conclusion: "It is especially through the payment of compensation that the cost of work injuries is brought home to the *entrepreneur*. Compensation laws have everywhere given a notable impetus to the safety movement."⁴

ADMINISTRATION

Early in the compensation movement in America it was generally accepted that this new legislation should be administered through commissions, usually made up of representatives from the employer, labor and professional groups. These commissioners with their deputies commonly give their whole time to the administration of labor laws. In many states with the coming of compensation all labor law enforcement has been unified through the industrial commission. Those who award compensation, and who thus visualize the daily procession of widows, dependent children and cripples, are also charged with the responsibility of seeing that the work-places are made safe. These commissions are then authorized, in co-operation with representatives of the various industries, to draw up detailed safety regulations which, after public hearing and publication, have all the force of law.

In some states the compensation commissions were the first safety law enforcement bodies; in others they have provided coördination for safety work previously undertaken in a less

adequate way by various separate bureaus.

Government equipment for safety has been further amplified by the requirements of prompt and detailed accident reporting as the first step in establishing the facts upon which a compensation award is to be made. Several states had no accident reporting whatever until it was required in their compensation laws; others were astounded to learn under workmen's compensation how incomplete and untrustworthy had previously been their so-called accident statistics.

Accurate information of the danger points in industry is prerequisite to effective accident prevention work and to intelligent rate making. Insurance carriers under compensation laws have increased their inspection service and rating board operations until the companies doing compensation business in New York State in 1923 reported that for this purpose they had spent that year in this country more than a million and a half dollars.

In a recent book the authors remark: "*It was not until we had compensation legislation that we had the 'safety first' movement. . . . Workmen's compensation legislation made accident prevention pay.*"⁵

FURTHER IMPROVEMENT NECESSARY

There was a sudden increase in accidents from 1923 to 1924. This, however, should not be taken as evidence of the ineffectiveness of compensation laws in reducing accidents, since it is reasonable to suppose that accidents would have increased at a much greater rate had there been no compensation acts. Rather it suggests that those directly engaged in safety organization have frequently

⁴ Workmen's Compensation, p. 131.

⁵ *Labor Attitudes and Labor Problems*, by Atkins and Lasswell.

failed to "sell safety" to the executives "higher up." There is still an industrial world that needs arousing to its responsibility. There is perhaps an equally pressing need of closer co-operation between (1) safety inspectors of insurance carriers, (2) safety organizers of business associations, and (3) official safety divisions of state industrial departments.

It may well be asked whether some additional stimulus to renewed safety effort should not now be applied. As Dr. Downey authoritatively observed in his final book on the subject: "*An adequate scale of compensation*

benefits is the prime requisite for the prevention of work injuries." Most of the compensation laws, it is well known, are still far from adequate. Pennsylvania with her maximum weekly limit of \$12 and a non-compensated waiting period of ten days following the injury is now disgracefully lagging behind other important industrial states. But there must be further improvement in the best compensation laws if they are fully to serve their twofold purpose of compensating the victims of occupational injuries while furnishing the greatest continuous incentive for accident prevention.

Inter-Relation of Compensation and Safety Work in New York State

By LEON S. SENIOR

Manager and Secretary, Compensation Inspection Rating Board, New York City

THE primary object of workmen's compensation is to make suitable provision for injured workmen and their dependents in the event of accident arising out of employment. But to prevent the occurrence of accidents is nearly as important, if not more so, than the mere payment of compensation after the injury has occurred. The state which is responsible for the legislation, the employer who wants to have his business conducted in an efficient manner and the insurance carrier whose function is to protect the employer at the lowest possible cost, all have an interest in accident prevention superior to the interest incidental to the payment of claims arising out of industrial accidents.

The subject of accident prevention has been in our minds for a long time but did not take real shape until the advent of compensation laws. The introduction of compensation laws has stimulated studies in accident prevention to a remarkable degree. With considerable foresight the insurance carriers, authorized to write policies in the state of New York, have provided an organized method for ascertaining facts relating to accident costs, to contributing causes, and to methods of prevention. A great deal has been done by the State Labor Department to encourage safety work among employers. The details relating to the constructive efforts inaugurated by the state will be recited in another part of the volume by others more competent to deal with this subject. My own

effort will be limited to show briefly the program mapped out by the insurance carriers for safety work as an incident to the administration of the compensation system.

There are upwards of 100,000 industrial establishments in the state of New York engaged in the manufacture of a variety of commodities, in the construction of public and private works and in the operation of public utilities. Many employers are interested in industrial safety, but not all give as much attention as they should to the problem. Employers conducting the smaller type of establishment require stimulus from the state and from private insurance carriers. In planning to provide such stimulus, the first step on the part of the insurance carriers in this state was to prepare the ground work in the form of statistical information. The data compiled by the insurance carriers consist of two parts:—experience showing the cost of accidents, and experience showing the causes of accidents. These statistical data become valuable to the actuary as a basis for ratemaking, and to the engineer as a basis for removing mechanical causes that contribute towards the occurrence of accidents. The actuary and the safety engineer employed by the insurance carriers have in this way made a valuable contribution to the work of industrial safety. These experts in the field of mathematics and engineering have devised rating plans the purpose of which is to appraise first the physical character of the industrial plant, and

second the morale of the management as represented by the experience of the risk.

INSURANCE RATING PLANS

I shall attempt here but a brief description of these two rating plans. As to the physical rating plan, it is the purpose of the workmen's compensation system to distribute the cost of insurance in the most equitable manner. In order to carry out this purpose effectively, every manufacturing plant of importance requires inspection as to the safe condition of machinery, and the employer is encouraged to safeguard dangerous conditions. The legal requirements for inspection of factories and the guarding of machinery are not sufficient within themselves to bring about complete protection to the employes engaged in hazardous industries. The rating plan introduced by the insurance carriers aims not only to provide standards approved by law, but wherever the legal requirements appear as inadequate the rating system demands safeguards of a superior type. While the laws of the state are designed to compel the employer under penalties to bring about safe conditions in his plant, the rating plan designed by insurance carriers provides an economic stimulus in the form of rate decreases for safe conditions and rate increases for dangerous environment.

A study of accidents and their causes has demonstrated that approximately one-third in number are due to mechanical causes. Safeguarding of machinery is therefore not entirely sufficient to protect the workman from potential injury. There must be developed within the establishment among the workers a mental attitude aiming toward the promotion of safety and the avoidance of accident. This mental attitude is best stimulated by lectures and frequent meetings, by oral persua-

sion and printed admonition, by house organs, bulletins and educational leaflets. Ultimately the safeguarding of the plant by removal of dangerous conditions, by introduction of mechanical safeguards and by education of management and workmen, will be reflected in the experience of the establishment. Accepting this theory as a basis, the actuaries employed by the insurance carriers have designed the experience rating plan, the purpose of which is also to provide an economic stimulus in the form of decreased rates for favorable experience, or increased rates for unfavorable experience.

It seems fairly certain that the compensation system has contributed directly and indirectly toward conservation of human lives. The extensive inspection of industrial establishments by the Labor Department, insurance carriers and rating organizations, the formulation of safety standards by the state and by public and private agencies, the education of the employer and the workman, the application of merit rating plans to workmen's compensation risks, all have had an important influence in the prevention of accidents. But notwithstanding the heroic efforts put forth by these several agencies, the effect statistically has not as yet become visible. I have figures before me for the year ending June 30, 1923, the latest period available for detailed analysis and review. These figures show that in the state of New York awards for industrial accidents were made in 58,078 cases. Roughly classified, 679 accidents resulted in death and total permanent disability; 473 in the loss of an eye, arm, leg or foot; 9837 in partial loss of members; and 47,089 in temporary disability exceeding two weeks in duration. Have the efforts of all these public and private agencies attained an adequate measure of success? If so, why are not the results apparent in the form of

reduced accident frequency? Are there cross currents that obscure and perhaps nullify safety work in industry? At least a partial answer to these questions has been given recently in a paper read by Mr. Leslie Hall before the Casualty Actuarial Society.¹ Mr. Hall makes the point that industry is not in a static condition. As the process of mechanization is constantly advancing, artisans and skilled manual workers are displaced gradually by machine hands. The elimination of manual workers from industry and their substitution by machine workers is one of the causes that contribute toward high accident frequency. Development of industrial machinery is on the increase, and the safety engineer must employ the utmost ingenuity to keep step with the inventor of productive machinery. The results of the work of the safety man are lost in the general array of statistical figures presented by the Industrial Commission from year to year. True, now and then a bright spot appears in the showing of large industrial enterprises such as the U. S. Steel Corporation, which is able to prove convincingly the fact that safety campaigns have reduced the number of accidents. The exhibits of these corporations are helpful in restoring confidence to those who are at times discouraged because of lack of proof as to the value of safety work.

PROMISING FIELDS FOR SAFETY WORK

As far as the large industrial establishment is concerned, the work of safety organization is co-ordinated and fits in closely with the problem of production. Because of the efficiency of the organization, the task of providing for the safety of employes is enormously simplified. The supervising executives and engineers of these large

plants realize fully the importance of waste motion, stoppage and delay that may result because of an accident to a worker. The superintendents and foremen of the plant are so schooled that the prevention of accidents becomes part of the general routine. The organization of safety committees and weekly reports on safety matters is something that finds a place in their daily life and the effect of safety effort becomes a matter of knowledge because of ability to maintain proper systems of accounting and statistics.

It is with respect to the smaller establishment that efforts of public and private agencies require intensive application. Here the employer is apt to pay little attention or to entirely ignore the problem for the reason that his mind is occupied with questions of production and organization to the exclusion of all other items. It is in the smaller type of establishment that the insurance carrier seeks a promising field for safety organization. Here we find competition for service among the insurance carriers on a basis of the merit rating system. Here the insurance carrier has an opportunity to convince the employer that it is to his benefit to provide safeguards for dangerous machinery and to introduce safety organization for the improvement of morale.

To an insurance representative, selling the idea of safety should not be very difficult. For the sake of illustration, let me point out that it is possible in a woodworking mill of a certain type to install a ripsaw guard costing \$25.00 which will return money dividends at the rate of \$50.00 per annum. It is in this way that the practice of merit rating becomes helpful to the employer and of positive benefit in preventing serious accidents. The conviction is growing on all agencies interested in safety

¹Hall, Leslie: *The Tendency of Labor-Saving to Increase Compensation Costs.*

work that reduction of accidents with consequent increase in efficiency can be accomplished best of all by education, so that the employer and employe may both realize the hazard existing in the most familiar operation. The education of the young people who are just entering into industry offers the largest degree of promise. This for two reasons: It is not only tragic for young people on the threshold of life to meet with accidents that will serve as a handicap in the future, but the education of the young holds greater hope in the way of safety for the coming generation. The older people who have worked in shops and factories have become accustomed to their surroundings to the point where familiarity breeds contempt for danger. In this case education in safety ways and methods is extremely difficult. A great deal more can be accomplished with the young apprentice, provided a right start is made under proper environment and with suitable methods.

FUTURE PROSPECTS

What are the prospects for further progress? The hope for greater safety in industrial enterprises lies in corre-

lating the work of public and private agencies, in extended universality of safety standards, in the development of common methods for the education of the employer, in arousing his humane impulses and in teaching systematically the economic values of safety and its social value to the community at large. The propaganda for safety work need not be conducted at all times along cold business lines. The methods of the enthusiast should not be looked down upon. A slight touch of the dramatic and the emotional may be of service if care is exercised to avoid an anticlimax. Exaggeration in this, as in other fields of endeavor, defeats the main purpose.

If the progress in the field of safety work has been slow, it is because the American employer and the American workman have not yet been fully aroused to the magnitude of the human and economic loss sustained by industry. It requires imagination to appreciate the full extent of the casualties suffered by industry in its peaceful pursuits. But as the sense of this loss becomes more realistic, accident prevention will have much better prospects for success.

Getting the Injured Man Back to Work

By HAROLD F. WEBB

General Safety Director, West Penn System, Pittsburgh, Pa.

THAT the statement, "more industrial workers are off duty on account of accident than from lack of employment" is a fact, has been borne out by many comparisons of these vital statistics. That employes off duty on account of accident and lack of employment are synonymous and dovetail one into the other, is understandable when consideration is given to the fact that the vacancy left by the injured man must either be filled by a temporary doubling up process or from the unemployed lists. That labor turnover being partially caused by employee accidents and breaking in the new employe to his assigned work are both costly experiments, bears out the absolute necessity of "getting the injured man back to work" with a minimum loss of time and before production demands replacement.

THE GOAL

But even more important than all given argument on this subject is the work that is constantly being done in all industries to the total elimination of employee accidents. It is an unfortunate fact that this total elimination will probably never be reached, since the human factor will always enter the equation, no matter what future mechanical developments may be brought to the industrial world for removing human labor.

Nevertheless, all roads in accident prevention work lead to this elimination of both accidents and resultant expense, and the combined efforts of industrial managers, safety engineers, doctors, and others continue to drive

the rugged road with hopes of meeting the end of the trail. When industry reaches this goal, there will obviously be no necessity of worry that attends "getting the injured man back to work," for there will be none off duty and the problem will be solved. The essentials necessary to this end form a well-beaten path followed by the industries over a period of years, and the first important step lies in safeguarding all mechanical equipment, and in the removal and correction of all non-mechanical hazards, etc., thus making satisfactory working conditions for the worker from the standpoint of safety. But engineering revision alone will not prevent accidents. Education is one of the prime requirements which govern safety activities and an industry without a well planned educational campaign for the workers may expect negative results.

Therefore, when the time-worn but authoritative statement is made that fully eighty per cent of employee accidents come directly from human faults, the value of a carefully prepared educational safety program may not be underestimated.

Campaigns and the like have been designed and placed in actual work by the hundreds for attracting and holding the workers on a keen edge in the prevention of accidents. But it is a fact that, in a great many cases, the effort is spasmodic when it should be continuous. Safety educational work is a sales proposition. Advertising principles are directly applicable and an honest effort to "sell" safety to employes means continuity of propaganda

and a versatility of advertising attack, bulletins, posters, and the like carefully planned and edited to attract the "buyer." But in spite of all the enthusiastic co-operation that is bound to be instilled by these campaigns, the good records and reductions caused by the educational propaganda, there comes creeping in, when least expected, a single or perhaps several employee accidents, any one of which may be serious enough to cause loss of time and ruin the record which required real co-operative effort to build. It is right here that safety progress should never be allowed to lag, for the principles of accident prevention work demand the protection of the worker both before and after the accident.

UP TO THE SAFETY ENGINEER

Effective service in lessening human waste—the aftermath of accident and improper first aid treatment—comes only through the maintenance of adequate nearby hospital facilities and through co-operation between the safety engineer and the industrial doctor. Hence, an adequate safety program includes a well organized, comfortable first-aid station. Haphazard first aid causes recovery to drag through many months, starts and continues compensation disputes and cultivates mutual distrust between management and claimant. It is always good practice and co-operation, when an injury of a possible disabling nature occurs, for the industrial doctor to get in touch with the safety engineer, superintendent, or foreman before the injured employee is allowed to leave the plant, if possible. The doctor is able to decide whether or not the injured man is capable of performing light work, and, by co-operating with these interested members, many times it is possible to give the man a temporary change of work which will keep him on

the job until he can resume his regular duties.

However, in this case light work should always be construed as meaning "gainful duty." In allowing the return to light work, the seriousness of the injury is not magnified in the mind of the employe by sending him home, and much is done to prevent future hospitalization. If it is necessary to send the injured man home, the safety engineer as a rule greatly appreciates the opinion of the medical department as to the extent of the injury and the probable loss of time, for it is his interest to keep in constant contact with the case and exert himself in causing the early return of the man to work. There are several good reasons for this effort and it is probable that the most prominent ones are to be found in his interest in the welfare of all men, an anxiety to show improvement in severity rate, which rate is the real indicator of progress in safety work, and to reduce compensation costs to a minimum.

The average industrial employe, skilled or unskilled, known as the steady worker is given to early return with but little coaxing on the part of the safety engineer or others. Generally speaking, this type worker is of an age where his physical self not only requires daily exercise, which comes to him through labor and thus even brief lay-off becomes intolerable, but he can ill afford the money loss, when full earning capacity is needed in the support of his family. No compensation laws have ever been enacted for compensating an injured employe in an amount equivalent to his earning power. It stands to reason that the amount of compensation allowed will always be held at fixed minimum and maximum amounts, otherwise there would be little to attract the return.

Next in line of thought may come the old employe. His accidents, while

probably few and far between, are usually severe when they do come, for age retards recovery. But dependence can be placed in his early return, for he is crossed by loyalty to his employers and fear of replacement by a younger and more active man.

The young employe, with all the impetuosity of youth, brings a problem to the safety engineer from the first day of employment. He is an unbroken colt to industrial methods, and his slap-bang manner of working, his natural curiosity, frequently cause his unskilled hands to result in injury either to himself or others. When actually injured he will generally take his own time about returning and sometimes shows a streak of obstinacy when approached with a suggestion of early return. Several reasons could be offered to explain this attitude and all would probably sum up to his lack of loyalty, responsibility and interest in the work. But even the most stubborn cases may be returned to work, following advice of the attendant doctor and depending largely on the persuasive power of the safety engineer.

Now the toughest problem of all, the lowest paid class of unskilled labor, which class is largely made up of the foreign type. These men are not interested in the ambition of the safety engineer to maintain a good record; in fact, many seem to lack the ambition needed to pull themselves out of the rut. When injured, getting this type back to work sometimes consumes the whole bag of tricks owned by the safety engineer. Safety educational propaganda of any kind seldom registers as being worth while in his mind and this may partially be on account of his failure to clearly comprehend what it is all about. But sometimes one is given to think that men of this type do not want to understand, on account of the unfortunate fact of their belonging to

several beneficial associations which, together with compensation, causes them to draw more money by laying off on account of accident or sickness than by working. Many times the safety engineer will find the supposed injured man working at various jobs requiring physical strength, which would not be possible to accomplish when suffering from real injury.

Of course in cases of this kind it is sometimes necessary to force the issue. It should be understood that malingerers, accident fakers, and the like are to be found in all classes of labor. Fortunately, compensation laws give some protection against such cases by requiring the employe to submit himself for examination, upon the petition of the employer. If the employe, without reasonable cause or excuse, disobeys or disregards such order, or if he is declared physically fit for work upon examination and then refuses to return, he is deprived of his right to compensation.

Summing up, "getting the injured man back to work" results in a three-cornered conflict between injured man, doctor and safety engineer. It is always essential that the safety engineer gain a full personal contact with industrial doctors and all employes, as this friendship on his part with all men will reflect in increased co-operation, enthusiasm, and loyalty when occasion demands that the matter of return to work be discussed with the injured employe. This problem will always be one to cause the safety engineer considerable worry, especially since lost time works directly against safety progress. The only relief in sight lies in the continuous attempt at correction of all unsafe working conditions and the continual waging of an educational war against employe carelessness, all of which tend toward an elimination of time losing accidents.

Rehabilitating the Worker When Accident Prevention Fails

By S. S. RIDDLE

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REHABILITATION renders fit for suitable occupations workers disabled by industrial accidents and permanently prevented from competing in the open labor markets for the tasks they once performed. It is one of a trinity of forces vitally affecting workers in industrial employments. The other two forces are accident prevention and workmen's compensation.

In relative importance and chronological sequence, accident prevention stands first. When accident prevention fails—whether through unforeseen causes, carelessness of workers, or lack of safeguards—the forces of workmen's compensation and rehabilitation begin functioning. Workmen's compensation distributes, as a part of the cost of production, payments in lieu of interrupted wage when injuries in employment disable or cause death to workers.

Rehabilitation develops the remaining capabilities of the permanently disabled workers for industrially productive and wage earning purposes. Employment, suitable and remunerative, is consequently the objective of rehabilitation. Rehabilitation begins when convalescence has reached such stage that the disabled person may enter an occupation or training for an occupation.

ORIGIN OF REHABILITATION

In past ages, when occupations were followed and transportation accomplished without ponderous, high-speed

machinery, war was considered as the most hazardous activity in which human beings could engage. Wars are to-day more hazardous than in past ages, but within the last hundred years the constant substitution of machinery for manual operations in industry and the development of heavy, rapidly moving vehicles of transportation have brought hazards more constant and threatening into our daily lives.

The World War drew the attention of all nations engaged to the necessity of reclaiming the wounded and physically disabled veterans for suitable occupational activities upon their return to civil life.

Comparative figures, developed at that time, indicated that the casualties of industry, continuing inexorably year after year, create more permanent physical disabilities, over a period of years, than the casualties of war. As a result, rehabilitation for reclamation of persons disabled in civil industrial pursuits became a new force in industrial operations.

The United States Congress enacted in 1918 the first legislation for the vocational rehabilitation and return to civil employment of disabled persons discharged from the military or naval forces of the United States. The President approved the legislation June 27 of that year.

Two years later, June 2, 1920, the President approved a Congressional enactment "to provide for the promo-

tion of vocational rehabilitation of persons disabled in industry, or otherwise, and their return to civil employment."

Seven states had previously created by legislation definite agencies for rehabilitation of disabled civilians. Pennsylvania was one of those states and was the first to make adequate appropriation for start of the work on a state-wide basis. The Pennsylvania industrial rehabilitation act was approved by the Governor July 18, 1919.

WHEN ACCIDENT PREVENTION FAILS

Industrial workers disabled permanently by employment accidents may range from fourteen to seventy years of age, with perhaps the greatest number in any ten-year group between the ages of twenty-one and thirty years. All, excepting those workers totally and permanently disabled, should, however, be returned, if at all possible, to suitable productive tasks in industry.

Broken mechanical equipment consumes only ground space and does not consume other production. Industry generally is constantly alert to the salvage and utilization of broken mechanical equipment, as well as development of by-products that might otherwise be waste.

Reabsorption of disabled workers by proper placement in industry has its humane but primarily economic benefits. When a disabled worker is suitably placed in employment, an able-bodied worker, who might otherwise be performing such task, is released for other employment which cannot be performed by a physically handicapped person. The effect of a great number of such transpositions on local labor shortages is apparent.

Rehabilitation applies to the personnel or human element in an industrial operation the same principles of

conservation, salvage and engineering balance as have for years controlled the material equipment.

Many incidental but nevertheless important influences bear upon the progress of rehabilitation in the case of each disabled person. Consequently, each case must be developed individually with every factor considered. The remaining physical capabilities of a permanently disabled worker determine the original course of rehabilitation. Mental attitude, capabilities and basic education are essential factors. Economic pressure and domestic responsibilities, with consequent necessity for early return of a disabled worker to a wage earning status, frequently prevent the development of what might otherwise be ambitious training programs. Definite residence locality of a disabled person, from which community existing economic and domestic reasons make a change inadvisable, has strong bearing on rehabilitation procedure in numbers of cases. The training facilities, accessible and suitable for the accident victim, considered with the employment prospects, affect the extent of rehabilitation in each case. Available employment opportunities, in connection with all other factors, must be, for each case, the ultimate guide.

Finally, after the accident victim's case is studied and developed, rehabilitation may be realized by:

- (1) immediate placement in a suitable task;
- (2) placement in employment training to qualify for suitable task;
- (3) placement in employment in conjunction with correspondence school course, evening school training or tutorial instruction;
- (4) placement in institutional training to qualify for suitable employment at completion of course;
- (5) guidance and assistance in establishment of individual, commercial, agricultural or mechanical business enterprise.

When accident prevention fails and a worker in an industrial establishment sustains permanent injury, there are usually two general lines of rehabilitation possible.

- (1) Rehabilitation by training for an occupation outside the establishment or industry in which the worker was injured.
- (2) Rehabilitation for suitable employment within the establishment or industry where the worker was injured.

It is principally among the disabled persons of the younger age groups, with basic education, ambition and freedom from economic pressure, that rehabilitation may progress to remarkable and unexpected limits outside the industry in which the injury was sustained.

In numbers of cases and especially among those disabled persons of the higher age groups, of limited education and heavy domestic responsibilities, the second line of procedure is the only logical one to follow.

REHABILITATION OUTSIDE THE INDUSTRY

Many young disabled persons have been aided or are now being aided by the Bureau of Rehabilitation in Pennsylvania through courses, in colleges and other higher educational institutions, in law, engineering, pharmacy, fine arts, commerce and finance and in preparation for the teaching profession.

Others have been trained for clerical, stenographic and other commercial employments. Training for various trades and other occupations has been made available, including watch repairing, engraving, undertaking and embalming, commercial telegraphy, radio operating, advertising, insurance, automobile repair, drafting, baking, paper hanging and painting, brick laying, piano tuning, showcard writing,

mechanical dentistry, shoe repairing, acetylene welding, real estate conveying, and many other tasks.

Rehabilitation procedure is in any case just as successful as the disabled person, for whom a suitable program is outlined, will co-operate to make that program a success.

Six years ago a youth of seventeen years lost his right arm at the shoulder in an industrial accident. His parents were foreign born. The young man lived in a small community supported mainly by the large industry in which he was injured. He registered with the Bureau of Rehabilitation and was encouraged to return to public school in order that he might enter high school the following year. The young man returned to school and in 1923 was graduated from high school, standing fourth in a class of thirty-six. That young man is to-day attending college with the assistance of the Bureau and represents one of the most complete and ambitious rehabilitation programs instituted by the Bureau.

Another young man who lost his left hand at the wrist was encouraged by the Bureau to enter mechanical study. He later decided that he desired an engineering degree and is to-day a senior in a mechanical engineering course at one of the larger educational institutions. Those cases represent, however, the more spectacular and highly developed phases of rehabilitation.

REHABILITATION WITHIN THE INDUSTRY

In an industrial commonwealth such as Pennsylvania, with its predominating types of hazardous employments, the greatest immediate economic return, both for the community and for the industry, will probably be found in the rehabilitation or return to suitable employment, within the industry, of

those persons of the higher age groups unable to move from the community in which they were injured.

Experience of the Bureau of Rehabilitation in Pennsylvania indicates that only approximately ten per cent of the total number of persons returned to employment, or rehabilitated, were logical cases for extended training programs.

Rehabilitation within industry, or the reabsorption of disabled persons into industrial tasks, for the performance of which a comparatively short period of training or instruction is required, with possibilities for advancement of the worker as proficiency increases, is an important personnel and productive factor in industry to-day.

The old attitude of arbitrarily refusing to consider for employment applicants handicapped by definite non-progressive and non-communicable disabilities is gradually passing in most large industrial establishments.

The experience of the Bureau of Rehabilitation in Pennsylvania indicates that virtually all large employing establishments are willing to investigate their employment possibilities for the re-employment of their disabled employees. Numbers of establishments will not, however, consider employing a disabled person whose injuries were not sustained in the plant at which application for employment is made.

Only in the extremely hazardous industries is the saturation point in employment of disabled persons even approached. In those extra hazardous industries the policy of re-employment of employees disabled while at work has been operative for some years.

Employers, heads of large industrial enterprises, almost universally approve of rehabilitation, of its economic soundness and practical application. Rehabilitation has not, however, permeated as a sound business proposition

through all administrative controls of industry, as has accident prevention.

Most superintendents and foremen have a natural affinity for new equipment, new tools, to replace broken or completely deteriorated mechanical equipment.

The same informative and educational forces that, within industry, have made known to superintendents and foremen the cost of accidents that disable workers, must similarly make known the fact that proper placement of physically disabled persons will not retard production, but even perhaps, in some instances, increase it, and as a larger proposition benefit the industry, the disabled person and the community as a whole.

With restricted immigration and local spots of shortages of labor of a character that can be performed by certain types of disabled persons, medical inspection of applicants for employment is already changing in industry and certain to change more in future years. Applicants with non-progressive, non-communicable physical disabilities will not be arbitrarily rejected for employment by an industry's medical inspection division. Instead, the medical inspection will be linked more closely with the personnel and operating divisions of the plant. Disabled applicants will be examined to determine what tasks in the industry they can suitably perform and, if otherwise in sound health, will be so certified by the medical inspection division to the personnel and operating divisions.

There would seem to be no sound reason why an applicant for employment with a leg amputation, but otherwise physically sound and personally suitable, should be rejected when tasks to be performed by workers seated are vacant in an industrial establishment. The same reasoning with sound practical judgment can be used to economic

advantage in adapting many types of disabled persons to suitable employments.

REHABILITATION IN PENNSYLVANIA

The rehabilitation legislation in Pennsylvania created a Bureau of Rehabilitation in the Department of Labor and Industry, which Department administers the workmen's compensation system of the state. Rehabilitation was defined as the rendering of a physically handicapped person fit to engage in a remunerative occupation.

A physically handicapped person was defined as any resident of the Commonwealth of Pennsylvania whose capacity to earn a living is in any way destroyed or impaired through industrial accident occurring in the Commonwealth.

The Bureau of Rehabilitation began functioning throughout Pennsylvania January 1, 1920, with the central office at Harrisburg and branch offices at Philadelphia, Pittsburgh, Pottsville, Wilkes-Barre, Altoona and DuBois.

Information from the reports of industrial accidents submitted by employers to the Bureau of Workmen's Compensation, of the Department of Labor and Industry, is transmitted from that Bureau to the Bureau of Rehabilitation, of the same Department, when such reports indicate severe disabilities to workers. Information regarding disabled persons needing the services of the Bureau are also received from employers, insurance carriers, labor organizations, physicians, hospitals, social service agencies, interested individuals and the disabled persons themselves.

A registration form, which is virtually a questionnaire, is sent by mail, with a return addressed envelope, to all disabled persons reported to the Bureau. The return of that questionnaire, properly filled out, registers the disabled person with the Bureau and pre-

vents the expending of the Bureau's funds for travel costs of field workers visiting the disabled person solely for the purpose of obtaining preliminary information. The method of registering disabled persons by mail, although having great benefits from an economy standpoint, was begun in a tentative way because it was feared that persons blinded or unable to read and write English would not return the questionnaires or registration forms.

Purposely, the state coat of arms was conspicuously displayed on all communications sent to disabled persons in order that the official appearance would cause the recipients to have the communications interpreted. It was soon learned that the mailed registration form was effective, as approximately twenty per cent of the persons returning the questionnaires are unable to read or write English and approximately four per cent have defective vision in both eyes.

When a registration form is received at the central office of the Bureau at Harrisburg from a disabled person, a duplicate of that registration form is forwarded to the adjuster or field worker located in the district in which the disabled person resides. That registration form is the assignment of the adjuster or field worker to the case for the purpose of effecting rehabilitation by returning the disabled registrant to suitable remunerative employment, in accordance with all factors as previously outlined.

FEDERAL FINANCIAL AID

The Federal legislation made available to the states for the fiscal year ending June 30, 1921, the sum of \$750,000, and for the succeeding three fiscal years the sum of \$1,000,000 annually. This sum was to be allotted to the states in the proportion which their population bears to the total population

of the United States with the further provision that, for each dollar of Federal money expended, there shall be expended in the state at least an equal amount for rehabilitation purposes. The annual appropriation of \$1,000,000 was continued beyond June 30, 1924, by Congress, and is at the present time available to the states.

The Federal legislation placed the administration of the Federal Rehabilitation Act under the Federal Board for Vocational Education, and further placed the supervision and control of the expenditure of Federal moneys in each state under the State Board for Vocational Education providing, however, that in those states where a department is charged with the administration of the state workmen's compensation or liability laws, the legislature shall provide that a plan of co-operation be formulated between such state department and the state board charged with the administration of the Federal Act. Thirty-nine states have accepted Federal aid for rehabilitation and are actively engaged in the work.

Pennsylvania accepted the benefits and provisions of the Federal legislation by Act of Assembly, approved by the Governor, March 2, 1921. Pennsylvania's plan continued the rehabilitation work under the Bureau of Rehabilitation in the Department of Labor and Industry. The Department of Public Instruction reimburses the Department of Labor and Industry from Federal funds available for rehabilitation for such of the work as meets the requirements of the Federal Act. The allotment of Federal funds available for expenditure, on the matched basis, for rehabilitation purposes in Pennsylvania was, for the Federal fiscal year ending June 30, 1921, \$62,731.95. For each succeeding fiscal year Federal funds available for expenditure in Pennsylvania for rehabilitation purposes were \$82,832.38.

Appropriations in Pennsylvania for rehabilitation purposes have not equalled the Federal funds available and due to the fact that living maintenance of trainees and similar expenditures, permitted by Pennsylvania legislation, are not matchable from Federal funds, the amount of state money expended for rehabilitation in Pennsylvania has each year exceeded the amount expended from Federal funds. The greatest annual expenditure of Federal funds for rehabilitation in Pennsylvania was during the fiscal year ending June 30, 1921, when \$40,964.00 Federal funds were expended and the expenditure of both state and Federal funds reached the total of \$96,573.00.

Since that time the average annual expenditure for rehabilitation in Pennsylvania from both state and Federal funds has been approximately \$75,000.00. By that annual expenditure, the Bureau of Rehabilitation has functioned throughout the entire state, in every county, paying all salaries and travel costs of employees of the Bureau, paying for training of disabled persons and aiding financially in providing artificial appliances as arms, legs and braces necessary for disabled persons to return to employment.

RESULTS IN PENNSYLVANIA

On November 1, 1925, the Bureau of Rehabilitation in Pennsylvania had offered its services directly by mail to 6041 disabled persons, of whom 4425 had definitely registered with the Bureau. The cases of 3325 registrants have been closed so far as the statistical records of the Bureau are concerned, although, in the practical application of a general rehabilitation program, cases are finally closed only by death, permanent removal of a disabled person from the Commonwealth or by determined non-susceptibility to rehabilita-

tion. Once a disabled person is registered with the Bureau of Rehabilitation, he or she is always thereafter eligible to its service. For statistical purposes, however, a disabled registrant is considered rehabilitated when placed in employment that under average standards is suitable, remunerative and as permanent as any employment may be considered.

Among the total number of cases closed were 2264 disabled persons who were returned to suitable employment at an average individual wage slightly in excess of \$1200 annually. All of those disabled persons had been unable to obtain employment through their own efforts and had consequently appealed to the Bureau of Rehabilitation for assistance in returning to a self-supporting status. One annual payroll of those disabled workers for full time employment would be in excess of \$2,700,000. If, on an average, all of those disabled workers could be considered as remaining in employment for only five succeeding years, the ultimate economic return would be the production represented by a total payroll of \$13,500,000.

That estimate may be regarded as conservative from a financial standpoint and considers only productive return. It does not include consideration of elimination of dependency of disabled persons upon relatives or charity, nor the effect upon morale of disabled persons.

The preceding results were attained by an expenditure of less than \$400,000 combined state and Federal funds for all activities of the Bureau of Rehabilitation in Pennsylvania.

The Bureau has financially aided 281 disabled persons during training courses and on November 1, 1925, was assisting sixty-one in educational and training institutions. The amount paid in an individual case is the exact difference

between the weekly expenses and income of the disabled trainee and may not exceed \$15 per week.

Financial assistance has been granted by the Bureau in obtaining 462 artificial appliances, arms, legs and braces for disabled persons. The Workmen's Compensation Act of Pennsylvania does not provide necessary artificial appliances as a part of the compensation award, as does such legislation in a number of other states.

Excellent co-operation has been given the Bureau in Pennsylvania by employers. Many employers, including large corporations, are voluntarily providing necessary artificial appliances for their employes, sustaining amputations in employment, although not required by any legislation to take such action.

Among the 4425 disabled registrants in the Bureau's records November 1, 1925, were 870 who could not read or write the English language. The majority of the registrants were native Pennsylvanians, 2456. There were 427 born in the United States outside Pennsylvania and 1542 born in foreign countries. The age groupings were 547 under 21 years; 1188 between 21 and 30; 1097 between 31 and 40; 851 between 41 and 50 and 742 over 51 years of age.

The disabilities of the registrants may be classified as follows:

One hand.....	1,162
Both hands.....	39
One arm.....	525
Both arms.....	9
One leg.....	1,331
Both legs.....	127
Hand and arm.....	5
Hand and leg.....	11
Arm and leg.....	14
Multiple.....	78
One eye.....	263
Both eyes.....	164
Hearing.....	11
General debility.....	117
Miscellaneous.....	569
Total.....	4,425

The following table analyzes the school and occupational histories of 4425 persons registered with the Bureau between January 1, 1920, and November 1, 1925. Examination of that table discloses that the majority of disabled persons who never attended

school or had the benefit of only a few years in school, were among the higher age groups or were foreign born. The table also indicates the increase in numbers of skilled or partly skilled workers as the years of schooling increase.

NUMBER OF REGIS- TRANTS	YEARS IN SCHOOL	AGE GROUP					NATIVITY		CHARACTER OF TASK WHEN INJURED	
		Under 21	21-30	31-40	41-50	Over 50	In U. S.	In Foreign Coun- tries	Common Labor	Skilled or Partly Skilled
395	Never attended	2	43	128	121	101	65	330	314	81
101	1 year.....	2	15	30	30	24	34	67	87	14
158	2 years.....	7	24	49	37	41	73	85	112	46
280	3 years.....	12	65	87	62	54	143	137	182	98
306	4 years.....	12	78	87	75	54	169	137	171	135
408	5 years.....	34	96	105	87	86	272	136	201	207
573	6 years.....	65	135	151	126	96	380	193	263	310
544	7 years.....	98	167	134	78	67	439	105	194	330
820	8 years.....	164	295	148	103	110	692	128	266	554
262	9 years.....	63	80	57	31	31	227	35	80	182
268	10 years.....	51	71	60	50	36	240	28	50	218
310	Over 10 years..	37	119	60	50	44	277	33	53	257
4,425	Totals.....	567	1,188	1,096	850	744	3,011	1,414	1,973	2,452

Book Department

FACHIRI, ALEXANDER P. *The Permanent Court of International Justice — Its Constitution, Procedure and Work.* Pp. vi, 342. Price, \$5.00. New York: American Branch, Oxford University Press, 1925.

The aim of the author of this book was "to write a practical textbook on the Court and its work," and it has been amply realized. The book is a faithful exposition of the history, structure and work of the Court as they are covered by the official documents, and as such it should prove extremely useful to students to whom the documents themselves are not available or whose time for investigation is limited. But it is not more. It does not put the Court in any setting; it does not assist in solving any of the Court's major problems; and it does not clarify many of the questions which are under discussion in America. One chapter only is a departure from the four corners of the documents — Chapter VI on "The Court and the League" — and it contains a valuable discussion of the sanctions applicable to the Court's decisions. If the whole volume had been prepared with the same freedom, and if the author had taken more account of the growing literature on the Court, the work would have been more generally useful. As it is, it is hardly more than a valuable guide through the documents.

MANLEY O. HUDSON.

MASON, ALPHEUS T., Ph.D. *Organized Labor and the Law.* Pp. 265. Durham, N. C.: Duke University Press, 1925.

No one can take up this book without being stimulated to a new and broader view of the work of our judges. Dr. Mason shows in an interesting way that we are now calling on the courts to act as arbiters between two highly organized groups in society. Can a man's business be destroyed by a boycott? Can the non-union man be excluded from industry? Is there any legal protection by injunction against such acts? Can a union escape civil responsibility for the destruction of business rights which it plans and executes? All

these and similar problems are thrust upon our courts for solution. The legal and social education and the individual philosophy of the judge must needs influence his decision of these points, as must also the changing trends and currents of public opinion.

Dr. Mason selects the principal legal questions which arise in connection with organized labor. He sets forth the statute and the common law upon these questions. He concludes with the more recent court interpretation of the statutes.

Beginning with English law, he traces the growth of the principal doctrines down to the immediate present in our Federal Court decisions.

Among the subjects which are handled in greatest fullness are the doctrine of conspiracy, the injunction, picketing, striking and boycotting, the Sherman and Clayton Acts and their interpretation, and the suability of labor unions.

The author's treatment is fair and impartial. He points out both the early conservatism of the courts and the later exaggerated criticisms to which they have been subjected. Dr. Mason's analysis of the Sherman and Clayton Acts, as applied to labor organization, is a masterly one, and gives us the most accurate and impartial treatment which the subject has yet received.

The volume will be of particular value to students of the law, to university classes in labor legislation and to the legislator. It will be found invaluable by newspaper and magazine editors and writers, since it clears up many of the points which are now so incompletely and inaccurately handled in popular discussion.

J. T. Y.

HUFFCUT, ERNEST W. *Elements of Business Law* (Second Revised Edition). Revised by George G. Bogert, Dean of the Cornell University College of Law. Pp. 352. Price, \$1.48. Boston: Ginn and Company, 1925.

This treatise covers topics usually studied in courses on business law, such as contracts, sales, bailments, agency, business associa-

tions, and property. The text is clear and accurate. It is illustrated by well stated hypothetical cases. It contains a well chosen group of forms. It includes a glossary in which terms not explained in the text are defined and a workable index. Mr. Bogert in the second revised edition has to a considerable extent rewritten the original text and brought it down to date by the inclusion of late decisions and references to statutes pertaining to business relations. The subject-matter is admirably presented from the point of view of giving students some working knowledge of the more fundamental rules applicable to business transaction. Unfortunately, however, it will not be particularly serviceable in giving students an appreciation of the part which law and legal institutions play in economic organization, which, it would seem, ought to be the function of the study of law in secondary schools.

W. H. SPENCER.

ANDERSON, WILLIAM. *American City Government*. Pp. ix, 675. New York: Henry Holt and Company, 1925.

Most books on the subject of city government assume much by way of previous knowledge of government and politics. One merit of the present work is the fact that the historical and sociological background is sufficiently complete to enable the beginning student, without much previous training in political science, to study it with profit (examples, Chapters 7 and 8). And still this is done without giving the reader the impression that this material is being forced upon him. In other words, the selection of material, and the manner of presentation are both admirable.

Condensing the description of the forms of city government into one chapter, even though a detailed description be later given of the organization and work of the city council, will doubtless seem to many a rather scanty treatment. While the reviewer is entirely in accord with Professor Anderson's contention in the preface that the working processes of government should be put before structure, he still believes that we are to-day facing a danger of going too far to the extreme of minimizing the study of the form or structure, as in the past we

have over-emphasized this phase of our subject.

If it be granted, though, that the study of the function of government should take precedence over the study of structure, one will perhaps have some difficulty—making due allowance for the space limits of a single volume—in understanding why no consideration should have been given to the administration of any of those functions, for which in the words of the author, "city governments are created," namely, police, fire, education, health, etc.

To be sure, one chapter each is devoted to municipal functions in general; one to municipal administration, and two chapters to the civil service. Three excellent chapters deal with the usual three phases of municipal finance—revenues, expenditures and indebtedness. An unusually good index covering twenty-four pages adds much to the usefulness of the volume, both as a text and as a reference work.

W. BROOKE GRAVES.

MICHELBACKER, G. F., AND NIAL, THOMAS M., *Workmen's Compensation Insurance*, Pp. 503. New York: McGraw-Hill Book Company. 1925.

Despite its title, almost half of this book, by the secretary-treasurer and assistant secretary of the National Bureau of Casualty and Surety Underwriters, is devoted not to workmen's compensation insurance but to accidents in modern industry and to workmen's compensation legislation. The book is primarily descriptive rather than critical and constructive. This prevents it from being as informative as it might be and in some instances causes it to be positively misleading. No one, for example, from reading the chapter upon the public regulation of insurers would suspect how comprehensive and minute must be the supervision by the state in order to be adequate. In general the book creates the impression that both compensation laws and underwriting methods are in a more satisfactory state than is the case.

Of the many questions which might be raised concerning the adequacy of existing arrangements for preventing or compensating industrial accidents, there are two which the reviewer especially regrets to see

escape attention. One is whether accidents impose sufficient expense upon employers to make safety work pay. The inadequacy of the safety work in most enterprises suggests that the incentives to prevent accidents need to be substantially strengthened. The other problem is the possibility of making long continued benefits, such as are frequent in death and permanent disability cases, payable in terms of purchasing power rather than in a definite number of dollars. Few persons suffer greater hardship from changes in the price level than those who, because of death or permanent disability, are largely dependent upon income from insurance. The problem of basing benefits in these cases upon the value of money is obviously complicated by the fact that bonds and mortgages into which it is customary to invest reserves are payable in a fixed number of dollars.

In its comparison of monopolistic state funds and private underwriters the book manifests distinct bias. Economy is the only advantage of monopolistic state funds which is mentioned and no figures on its importance are given. The greater security of monopolistic state funds is not referred to and no allusion is made to any of the serious failures of private insurers. The underpayment of claims in doubtful cases, which investigations in New York and Illinois show to be surprisingly frequent, reminds us that the services of underwriters must be appraised from the standpoint of the injured men as well as from that of employers. When this is done, the arguments against monopolistic state funds based upon faith in competition as a stimulant to efficiency lose much of their force. Competition for business is not highly effective in stimulating insurers to go out of their way to provide the best medical attention for injured men, to pay claims promptly, or to avoid underpayment, for the simple reason that the workmen have no voice in selecting the underwriters. But the record of state funds in some of these respects is little if any better than that of private insurers. This fact, together with the wastefulness of competition, suggests that the ideal underwriting arrangement would be a monopolistic state fund ad-

ministered not by bureaucratic public officials but by trustees or directors representative of both employers and workers with possibly some representation of the state.

In conclusion, it should be noted that parts of the book, especially the chapter on acquisition expense and the discussion of the "not taken business" problem, should be of interest to students of general economic theory as well as to specialists in labor problems.

SUMNER H. SLICHLER.

RAYMOND, WILLIAM G. *The Public And Its Utilities*. Pp. xii, 346. Price, \$3.50 net. New York: John Wiley and Sons, Incorporated. 1925.

This is an interesting attempt to present a general introduction to the economics of public utilities. The author includes for this purpose only the so-called municipal utilities, electric light and power, gas, water, telephone, and electric street-railway utilities. The subject matter is comprised under four headings:

"1. What are the principles which should govern in establishing rates for service?

"2. What are the bases for, and the nature of, proper public control and regulation of privately owned public utilities?

"3. What constitutes a fair rate of return?

"4. How is the basis of this return, that is, the fair value of the property used in the service of the public, to be determined?"

In an introductory chapter the author first makes clear the distinction between ordinary private enterprises and those having a public utility character, the distinction being drawn upon legal premises. In two short descriptive chapters the author next presents a picture of the creation of a public utility business, of the character of operations carried on by the more common types of local public utilities, and of the nature of the more common revenue and expense items. It is of interest in this connection to note that he uses the illustration of a publicly owned plant in order to bring home the necessity of certain forms of capital outlay that have been the subject of dispute in connection with private enterprises.

The general subject of depreciation is next covered in a series of chapters, the treatment emphasizing the economic, engineering and accounting aspects. One may question the wisdom of discussing the related technical subjects that suggest themselves, such as the explanation of the fundamental concepts of accounting. Then follows a brief discussion of sinking and emergency funds, and of taxation of utilities both publicly and privately owned. The remaining two-thirds of the work the author devotes to the heart of his subject: (1) the discussion of rate-systems, illustrated particularly in the fields of electricity, water, and gas supply; (2) valuation of public utilities; (3) the fair return upon the valuation.

Between the discussion of rate-systems and the general subject of valuation the author has inserted certain material that ought to have been presented earlier, let us say where the author treats of the creation of public service enterprises. The material referred to is a discussion of the financing and organization of public utility companies, of franchises, control of capitalization, control of service. Then once more the author comes back to control of rates by public authority with special emphasis upon sliding scales. The final chapter on engineering methods of appraising property could well have been coördinated with the earlier discussion of valuation. In an appendix the book is equipped with the usual complement of amortization tables and illustrations of operating statistics.

Upon the mooted question of valuation the author appears to incline to the prudent investment theory, although he presents and explains what is the current practice under the rule of *Smyth v. Ames*. He makes the very interesting suggestion that interest be included along with other costs of operation in a total cost-base upon which privately owned public utilities should then be allowed a specified rate of profit (the author uses the rate of ten per cent). He calls this estimating the "worth of the service."^a The suggestion, very evidently, flows from a sense of despair that order will ever come out of the chaos of the conflicting rules of law relating to valuation.

The book appears to be written primarily for students in the engineering sciences. This may explain why such important legal problems as those arising out of franchises and the control of capitalization are given such cursory treatment. A useful feature of the work is the visual representation of the technical processes involved in furnishing service to consumers. The author is at his best, however, in the discussion of rate-systems.

Looking at the book from the point of view of the teacher, we must say that, although much useful information is presented in this work, the subject-matter as a whole is not presented in a way to afford the student an organic theory of regulation. It may be that the time for such a treatment has not come, or that the ordinary college text does not provide sufficient scope—along with the other things it must do—for such an undertaking. Yet the need for such a treatment is most urgent.

MARTIN G. GLAESER.

POFFENBERGER, ALBERT T. *Psychology in Advertising*. Pp. xix+632. Chicago: A. W. Shaw Company, Chicago, 1925.

In this volume Professor Poffenberger has brought together the most essential of the advances in general and special psychology that have found application in the discussion of advertising or that he can find a place for in explaining his own problems.

The chapter headings cover the familiar psychological terms and phrases, but the content contains much that has been especially developed in connection with the investigations of applied psychology. The laws of a more technical type are illustrated by a wealth of actual advertisements and a discussion of their relative merits for the different ends that they might be made to serve.

The discussions are sufficiently detailed to make the book a work of reference that furnishes the answer to most of the practical problems that might come up in the daily work of the advertiser. At the same time there is sufficient relation to general principles to make it valuable as a textbook or introductory work for the general reader.

W. B. PILLSBURY.

CHADDOCK, ROBERT EMMET. *Principles and Methods of Statistics*. Pp. xvi+471. Houghton Mifflin Company, 1925.

Unusual interest attaches to this work since its writer, the President of the American Statistical Association, has had rare opportunities not only in the teaching of statistics but in its application to almost every sphere of human endeavor. As professor of statistics in Columbia University he has had ample opportunity to test the statistical procedure set forth in this volume.

The book is planned to meet the requirements of a one-year course in statistics in college or university, supplemented by ample practice work in the laboratory. Throughout the writer stresses that statistics is only to be learned by doing. After certain preliminary considerations which emphasize the increasing appeal being made to quantitative data, the wide-spread misuse of statistical facts, and the great service which statistics may render to science, Dr. Chaddock takes up the main section of his book which is devoted to the classification and description of mass data. The frequency distribution is discussed in detail as are the simple methods by which quantitative data may be summarized—the arithmetic average, the median, the geometric mean, and the mode. The measurement of variation and index numbers are fully treated, followed by detailed discussion of measures of unreliability. The methods of computing correlation are discussed and sample problems worked through so completely that it would be difficult to miss the path. For the student who has computed his coefficient and knows not what to do with it Dr. Chaddock gives a few simple rules and cautions. And these cautions, incidentally, might with advantage be prayerfully considered by many of those who in the making of quantitative analyses do not consider themselves elementary students of statistics. The latter portion of the book treats the gathering and presentation of statistical data. The section dealing with ordinary errors in graphic presentation is especially full and satisfying. Five appendices include an excellent short bibliography, a summary of symbols, equations and formulae

used in the text and certain tables frequently used in statistical calculations.

Dr. Chaddock's approach is logical and empirical and he has not assumed a knowledge of mathematics beyond elementary algebra. Great care is therefore taken to avoid terminology and symbols which might be confusing to those who have not had training in higher mathematics. Throughout, the book is abundantly illustrated with charts and diagrams and tables of data drawn from a wide variety of sources. Dr. Chaddock has a decided flair for combining abstract statistical principles with interesting concrete illustrative material. For example, the fact that quantitative data of an historic series give an entirely different effect when plotted on the natural scale and when plotted on ratio or semi-logarithmic scale is interesting to the student—moderately interesting. But the two charts are scanned eagerly when the figures plotted show the relative gains in the production of passenger automobiles and trucks in the United States during the past fifteen years.

The book will doubtless be turned to with gratitude by many who have been seeking a satisfactory guide to escort students through the wonders and hazards of quantitative analysis.

HUGH CARTER.

Water Works Practice. A Manual issued by the American Water Works Association. Pp. 790. Price, \$5.00. Baltimore: The Williams and Wilkinson Company, 1925.

At the Montreal convention of the American Water Works Association, held in the spring of 1920, a council was appointed to study the problem of the standardization of water works practice. The "Manual" of *Water Works Practice* is the result of four years' investigation by members of this council and others. Its twenty-six chapters have been written by about fifty men with the collaboration of more than 300 technical experts. The council has abridged and unified the whole.

The task has been thoroughly done, and the "Manual" presents in comprehensive form a survey of the entire field of water

supply. There are chapters on the collection of water, the quality of the supply and its treatment, the distribution of water, and the financing and management of water works. Fire protection is also discussed at some length.

The editors state that their volume will be of interest mainly to "the members of water boards and commissions . . . ; the salaried officials who manage and supervise the works; and the specialists . . ." Their claim is too modest. The text is for the most part clearly and interestingly written, and the technical nature of many chapters should not destroy the value of the work for the intelligent layman who wishes to obtain a better understanding of the water supply problem and its solution.

AUSTIN F. MACDONALD.

SOROKIN, PITIRIM A. *The Sociology of Revolution*. With an introduction by Edward Cary Hayes. (Lippincott Sociological Series.) Pp. xii+428. Price, \$3.00. London and Philadelphia: J. B. Lippincott Company, 1925.

This is another and a more determined attempt to write history in terms of a natural science; that is to say, in terms of sociology. "It represents," in the words of the author, "not an ideographic description of the Russian Revolution but an essay in sociological analysis," an effort to describe what is general and typical in the phenomena of revolution in general.

The method consists in stating general theses and then marshaling facts to support them. For example, we learn that revolutions are characterized by sudden and widespread changes in human behavior. These changes are described as follows:

1. The change of the unconditioned and the conditioned reactions in ordinary times are of an individual character. . . . During revolutionary periods the extent and spread of change affects at once a considerable proportion of the total population.
2. Suddenness of change is a second manifestation. The disappearance of old habits and the development of the new ones, a process which previously occupied several decades, now occurs during a few weeks or months.

Then follows a list of some particularly striking illustrations based on the author's five years of personal experiences. Professor Sorokin, a leader of the Menshevik or moderate party under Kerensky, and later under the Bolsheviks, was one of the proscribed and condemned *intelligentsia*.

It has been said that sociology is merely a way of using hard words to say what everyone already knows. William James said much the same thing of the laboratory psychology so popular a few years ago. It was, he said, a mere elaboration of the obvious. The character of most of Sorokin's generalizations, even when enlivened and illuminated by the more concrete and specific illustrations which the subject matter so easily affords, come near to justifying this criticism.

The purpose is to state, no doubt, the phenomena in such abstract and formal terms that the events of one revolution can be compared with those of another, so that the conclusions which the author is able to draw at the end of the volume will have a general character. Thus it would be possible to say not merely that the Russian Revolution has turned out disastrously, but that all revolutions do and, in the very nature of things, must turn out disastrously.

If this were indeed possible it would show that sociology possessed the same superiority to history that algebra has to arithmetic, since algebra states in general terms what arithmetic can state only in specific terms. History gives us a fact, but sociology gives us a formula.

To look at the matter in this way is to treat revolutions, the Russian Revolution and all others, as a purely natural phenomenon, a convulsion of nature, something that in itself is beyond good and evil, since it is futile to moralize about the inevitable.

"The purpose of this book," says Sorokin, "is neither to blame, praise, apotheosize nor condemn revolution. It is only to study revolution in all its reality."

It is not revolution, then, that kindles the indignation which occasionally rumbles and flashes through the pages of this "prosaic" investigation; it is rather the folly and the imbecility of those misguided persons who have made an "idol" of revolution; who have thought that revolu-

tion was "a method for the improvement of the material and spiritual conditions of the masses." This is the point of view of the author, and it is necessary to mark this fundamental conception if one is to estimate the significance of this unusual book.

What Professor Sorokin has actually attempted to do is to construct on the basis of his personal experiences as well as his wide reading in history, a natural history of revolutions; to create a new type or species in the field of politics which may be made the subject of further observation and study. It is, in short, another illustration of the tendency which one encounters so frequently in recent years to push the naturalistic, as over against the moralistic and philosophical methods of inquiry, into the realm of political and social life.

What will interest the general reader in this volume, however, is not the method but the incidental comments upon the Russian Revolution which is the basis of this study.

More interesting than any other portion of the volume are the chapters which review the statistics of the period before and since the revolution and show how miserably the revolution has failed to fulfil the promises made for it both by its promoters in Europe and its apologists in America. Those who are eager for facts to discredit communism as an economic and political ideal will find them here. And this no doubt explains why, in spite of the pedantry of its naturalistic style, it has met with such favorable comments in the popular reviews; it is certainly, regardless of its theme, not an easy nor an interesting book to read. Even as a work of science, the best, and perhaps the worst, that can be said of it, is that it is suggestive. It is a signpost indicating the direction in which social science is moving.

ROBERT E. PARK.

BROWN, LADY RICHMOND. *Unknown Tribes, Uncharted Seas*. Pp. 268, with 52 illustrations. New York: D. Appleton & Company. 1925.

That peoples in an uncivilized stage of culture are the property of anyone who comes along to claim them, seems to be true in a literary as well as in a political sense.

Their lives, their habits, their temperaments and their motives are left to be interpreted to the meddlesome world by casual tourists who acquire no more than a six weeks' dash at their language, who peep in at their "outlandish ceremonies" and stare at what can be seen of the intimacies of home life. The book of Lady Richmond Brown is a typical one of this cut. She with a countryman cruised in a small yacht among the islands of the Panama coast and visited a number of island settlements of the San Blas Indians. Their object was primarily to seek diversion, but in achieving this end they elected to heal the ailments of the natives (neither were of the medical profession) by generous administration of sulphur ointment and red-flares! Yes, they actually terrorized a village of Chucunaque Indians in the interior of the isthmus "who had never before seen a white man or a white woman" as a part of their therapeutic process. Nevertheless the men all wear manufactured hats and the women dresses of print goods! Her ladyship has given the public a readable book but not one which will live and wax greater.

For the serious reader there is some actual information on the government and customs of the San Blas who seem to be ruled by local overlords. Their social relationships she depicts as ideal, for the most part, but her opinion is worse than erroneous when she says (p. 155), "In many instances they were undoubtedly incestuous," and attributes this condition to the influence of the medicine man, against whom, incidentally, she seems to have borne a grudge. She describes puberty ceremonies (p. 152), poison arrows (p. 152) and says that albinos form about ten per cent of their numbers (p. 156). Her sociological observations are decidedly untrustworthy, as might be expected, since a summing-up of her recorded residence in the Indian villages themselves amounts to but a few days. The remarks on language (p. 268) are the same: "It is a question whether it consists of more than two hundred words." (*sic!*) She thinks their range of sentiments was embraced within the scope of the term "good"—"instead of a flow of voluble remarks, such as we might make, they

would simply nod and say 'nueddee' (good)."

The authoress shows a delightfully feminine simplicity and a fine human spirit, and causes her readers to rejoice with her for the good she accomplished in alleviating the physical ills of the Indians whom she graciously refers to as "a wonderful people." Some exaggerated trivialities would seem inevitable, understanding her background and the situation on the isthmus. Whether or not the authoress intended it, she at any rate succeeds in showing up her companion, "Midge," as an ass (p. 185 *et passim*)—notes him for a green and petulant woodsman though by all odds a red-blooded one.

It is unfortunate that Lady Brown did not consult some of the more accurate sources of published information on the tribes of this and neighboring regions while preparing her book. She would then not have been taken in by some unscrupulous person who sold her the preserved heads (ill. opp. p. 262). These are clearly fakes, the very things the South American governments have declared contraband, to stop their manufacture at the hands of ghouls. She might have been more sceptical, moreover, about the hieroglyphic values suggested for the patterns on the women's embroidered dresses of which some 1600 were collected, and she might have given the authorities of the British Museum a more deliberate chance to suggest for these designs an esthetic rather than a cabalistic origin. She might also have given her readers credit for somewhat keener perception of the indiscrepancies between the text of her narrative and the titles of some of her photographs in which evidently the name San Blas should appear instead of Chucunaque. Charity would prompt us to attribute this to error rather than to intention.

FRANK G. SPECK.

VON HANSTEIN, OTFRID. *The World of the Incas, A Socialistic Study of the Past* (translated by Anna Barwell). Pp. 189. Price \$2.50. New York: E. P. Dutton & Company.

A realm that flourished in the 14th century in the Peruvian highlands at an

altitude equal to that of Mont Blanc! A dynasty claiming descent from the sun of thirteen generations born of brother-sister marriages, that endured four centuries, then fell before the greed and treachery of the Spaniards under the Pizarros! Cities, fortresses, temples, and treasure-houses and gardens of massive stone embellished with tons of gold! Communal labor under imperial overseers, distribution of property, food and wealth according to need and desert, population census, labor and military census, an imperial school of learning, road making, mining and irrigation systems, postal communication, deliberate conquest, colonization and culture absorption of racial elements, the pomp and glory of an illustrious and spectacular court—and the final dramatic collapse! The book is a vivid portrayal of an extinguished socialistic state, obedient children under despotic but kind emperors. Showing splendid historical perspective and free from unusual sentimentalism for the magnificence and innocence of Inca control, the work is decidedly one of merit, intended to instruct and to entertain the many in whose hands it is already to be found, since the author's task is carried out with taste, judgment in selection of topics and emphasis on important features. It is worthy of becoming a text book for students of ancient political science, more technical than Sir Clements Markham's treatise on the Incas. A few lapses into sentimentality and some innocent ignorance of elementary South American ethnology, however, may be overlooked.

Considering Inca times from the present viewpoint, with an observant eye abroad and into the future, the importance of this study to the social investigator lies in the extreme to which communism was carried by the Incas, resulting in the loss of every kind of personal liberty in act or movement. Each subject of the empire "was nothing but a wheel in the great, highly finished mechanism of the state machine" which, however, "revolved in care for all citizens of the Kingdom."

The book is a modern and able production that will find a multitude of admirers among those who, for variety, turn from fiction, or for relief turn from pure

science, to the enjoyment of thoughtful reading in the history of ancient cultures.

FRANK G. SPECK.

WEIGALL, ARTHUR. *A History of the Pharaohs*, Vol. I, The First Eleven Dynasties. Pp. 328. Price \$6.00. New York: E. P. Dutton and Company.

It would be well if political scientists, economists and sociologists were to study more carefully than they sometimes do the great civilizations of the Nile and the Euphrates. Owing to the amazing discoveries of the last hundred years we know the political, business and social life of the remarkable peoples who inhabited these river basins in many respects more minutely than we know the life of Greece and Rome. Mr. Weigall has undoubtedly made an important contribution to the history of Egypt, but whether his work will prove of much immediate interest to the readers of this journal may be doubted. His attention is particularly engaged by questions of chronology and he has devised a new scheme, based on a thorough study of the Turin Papyrus and the Palermo Stone, by which he claims to be able to fix with great precision the dates of the various dynasties and reigns back to Menes, the first king of the first dynasty (3407 B.C.), and even to recover for history some eighteen hundred years prior to Menes, which has hitherto been regarded as prehistoric—no slight achievement, if his views should be finally accepted by his professional colleagues. His history is, however, limited in scope, for it is largely confined to a somewhat annalistic account of the various Pharaohs, and in the case of these early ones, biographical material is very scanty. Mr. Weigall's account of the building of the Great Pyramid relieves Kheuf (Cheops) of much of the odium which has traditionally attached to that enterprise. The Pharaoh, it would appear, did not strain the resources of his kingdom or interfere with the productiveness of his people in order to rear this mighty monument. He used their labor only during the three months, each year, of the inundation, when they would otherwise have been idle. The work was a valuable means of training for the people in organization and efficiency. There are many pleasant

genre pictures scattered through the book, drawn from the actual records of the people. Compare, for example, the account of the way in which an assistant treasurer in the reign of Nebhaptre Mentuhotpe (2171-2125) cared for the village of Gebeleyn during a famine (p. 300). But the contributions which Mr. Weigall has to make to the biographies of Abraham and Sarah (pp. 318-321), in addition to what is recorded in the Old Testament can hardly lay claim, in the opinion of the present reviewer, to any historical value.

KEMPER FULLERTON.

BOWBEN, WITT. *Industrial Society in England Towards the End of the Eighteenth Century*. Pp. 342. Price, \$3.50. New York: The Macmillan Company.

Here is an effort to present a comprehensive survey of the early industrial revolution in England and withal, in a somewhat new light, and not without some success. We have no quarrel with the emphasis which the author seeks to put upon the evolutionary character of this movement. He is in accord with the whole trend of modern thought. But why go out of his way to belittle the great inventors of the era, or their work; or the famous treatise of Adam Smith and its influence? The author, in fact, while deprecating the dogmatic spirit in which the historian has hitherto treated this field, himself lapses into the vicious habit at times. The style, also, is frequently burdened with "six-footed words," which, while giving the thought an air of breadth and profundity, rob it of clearness and force. Gibbon or Dr. Johnson could make little fishes talk like whales and get away with it; but to-day, readers will not spend much time mulling over words which they do not understand, or sentences that have no spearing points.

The book, however, will not be without value for the reader who has the patience to follow through the labored periods. The author presents an old theme from a new point of view and this is always worth while, even though we may not accept his conclusions. There is, also, to be found here much new material of importance: The forerunner of the modern chamber of commerce is to be found in the General Chamber

of Manufacturers of Great Britain, organized in 1785; the early "Box Clubs" or "Friendly societies" help us to understand the beginnings of the modern trades-union; Pitt's Irish policy, also, is set forth with clearness and understanding. But the attempt to minimize the evil effects of the rapid introduction of machinery upon the workers is not so convincing; neither are we quite ready to find the origin of the "Free-Trade movement" in the competition of "machine armed industries," to the exclusion of the influence of Adam Smith and the theories of the Physiocrats.

An important part of the work consists of twenty-three pages of bibliography of which a large proportion of the titles are of unpublished works, or forgotten articles of the reviews, for the most part unknown to the ordinary student of politics.

BENJAMIN S. TERRY.

WOODS, ROBERT A. *The Preparation of Calvin Coolidge*. Pp. 288. Price, \$1.50. Boston: Houghton Mifflin Company, 1924.

"Calvin Coolidge went through a more consistent and complete preparation for the presidency than any previous incumbent." This is the thesis. Even the friendly reader will hardly be convinced. The eulogy is too broad. The presidency is too narrowly conceived. The book gives no indication that "complete preparation" should, or does, leave a president other than provincial. It is distinguished, however, from the typical campaign biography by the unusual extent of the author's information, his own character and sincerity, the vagueness regarding the Republican party, and the small space given to controversy. The emphasis is on positive values in Mr. Coolidge's experience and observation. He moves forward, "in his life career of public service," somewhat mechanically and inevitably, but always usefully, always one step at a time, singularly independent toward mere things, mere men, and mere words, and, mayhap, very "consistently prepared" for the presidency in these United States of 1925.

H. L. KING.

FISHER, MRS. H. A. L. *Then and Now, Economic Problems after the War, a Hundred Years Ago*, with an introduction by the Rt. Hon. David Lloyd George, O.M. Pp. 113 and Bibliography. New York: Oxford University Press, American Branch.

This is not poetry, as the title might suggest, but a very serious and substantial study of some grave economic and social problems that confront world statesmen to-day. Mrs. Fisher has made a study of the troubles and disappointments of the period that followed that other great world war that closed in 1815. The points of resemblance with the lessons involved are strikingly and lucidly set forth. The work is important enough to attract the attention of Lloyd George who, in his usual energetic and comprehensive way, has written the introduction.

There is the conventional bibliography at the close of the volume, not as pretentious as the preceding, but possibly more practical from the point of view of the student.

BENJAMIN S. TERRY.

BROOKS, SIDNEY. With a Preface by George Barr Baker. *America and Germany, 1918-1925*. Pp. 191. Price, \$1.50. New York: The Macmillan Company.

This is an account of the re-establishment of relations between America and Germany from the Armistice to the present. It begins with the dark days of the Revolution in Germany and ends with a discussion, and the probable future effects, of the Dawes Report. Though not entirely free from the assumption that Germany was to blame for much of the delay in economic reconstruction, America's controversy with the Allies in attempting to remove the blockade after the war is clearly set forth, especially the part played by Mr. Hoover. In striking contrast with the efforts of France to block every attempt to disentangle the shattered relations, stands the work of the Friends, whose disinterested activities in relieving misery and turning hate into love, forms the most inspiring part of the narrative. The book is based in part upon documentary material hitherto

unpublished, and it should be especially welcomed because it is among the first of its kind in which the facts are presented in a way to lead to a better understanding between Germany and America.

KARL F. GEISER.

JEUDWINE, J. W. *Religion, Commerce, Liberty: A Record of a Time of Storm and Change; 1683-1793*. Pp. 391. Price, \$3.75. London and New York: Longmans, Green and Company.

The work of this well-known writer falls under four general heads: The European Society, Commerce, Revolt against Authority, and The Revolution. The subtitle suggests the nature and character of the volume, for the century under consideration is one of violent change and transition, of movement, of action, of wide travel and adventure, of many wars. If one were to single out the dominant note running through the narrative, it clearly would be

the part that trade has played during the period under consideration. If it is written with a purpose other than purely historical, which is not to impute a fault or defect, that purpose is best expressed in the author's own words: "We might at least learn from the 18th century that our business is world trade and with it world peace, and that no Empire and no supremacy in trade can ever be permanent without the support of Religion and Liberty."

It is a thorough study,—especially valuable to students of trade and commerce,—supplied with useful tables, charts, maps and indexes, written in an interesting style characteristic of English scholarship.

KARL F. GEISER.

Commonwealth Fund Program for the Prevention of Delinquency. Progress Report. New York: Joint Committee on Methods of Preventing Delinquency, 1925.

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